THE GEOGRAPHICAL JOURNAL

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL
EDITED BY THE SECRETARY

VOL. LXI.—JANUARY TO JUNE 1923

LONDON
THE ROYAL GEOGRAPHICAL SOCIETY
KENSINGTON GORE S.W.7
EDWARD STANFORD, LTD. 12 LONG ACRE W.C.2
1923

PRINTED BY
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LONDON AND BECCLES, ENGLAND.

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The Geographical Journal

Vol. LXI No. 1 January 1923

AN ASCENT OF KILIMANJARO

C. Gillman

Read at the Meeting of the Society, 27 November 1922.

SINCE Africa's highest mountain was first seen and approached by Rebmann in 1848, and since Sir Harry Johnston's pioneer work on the upper slopes in 1884, eighteen men and at least one lady had reached the icy rim of the great crater on its summit. The first Englishman to climb to the top was Mr. W. C. West, of Capetown, whose ascent was accomplished in June 1914. Dr. Foerster, a German settler at Moshi, had, by the construction of three alpine huts, done much to facilitate the approach to the upper regions, and scientifically the mountain had been explored by Dr. H. Meyer * in 1889 and 1898, by Dr. C. Uhlig † in 1901 and 1904, by Dr. F. Jaeger ‡ and E. Oehler in 1906, and by the latter and Dr. F. Klute § in 1912. As early as 1900 Dr. Meyer had published his splendid standard work on Kilimanjaro, and the last publication by Dr. Klute (reviewed in the *Journal* for October last) is an up-to-date summing up of our present knowledge of the great ice-capped equatorial volcano.

The party which I led a year ago has, therefore, by no means trodden new ground, but the facts that we were the first to ascend after the mountain had become British territory, and that, since the publication in 1891 of an English translation of Dr. Meyer's first Kilimanjaro book, ‖ no connected account has appeared in English geographical literature, would appear to justify my attempt to tell you of our experiences.

But before doing so let me give a general idea of the mountain's characteristics.

From wherever, across the surrounding steppes, one approaches the isolated mountain mass, two outstanding features impress themselves at

* Dr. H. Meyer, 'Der Kilimandjaro,' Berlin, 1900.

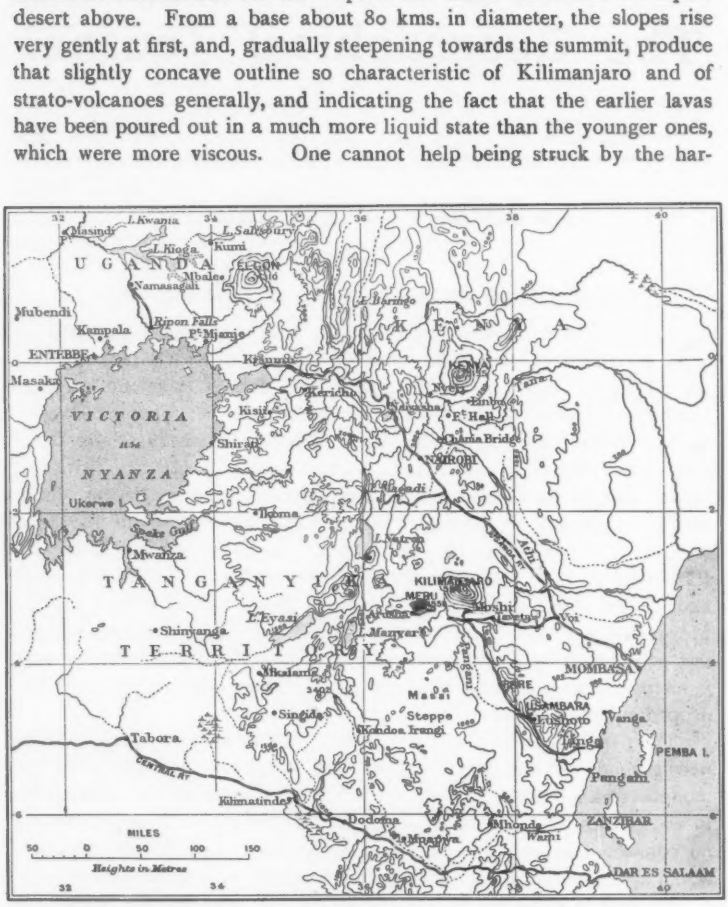
† Dr. C. Uhlig, "Vom Kilimandscharo zum Meru," *Zeitschrift Ges. f. Erdkunde*, Berlin, 1904.

‡ Dr. F. Jaeger, "Forschungen in den Hochregionen des K.," *Mitt. D. Sch. b. Berlin*, 1909.

§ Dr. F. Klute, 'Ergebnisse der Forschungen am K.,' Berlin, 1920.

‖ Dr. Hans Meyer, 'Across East African Glaciers,' London, 1891.

once: the tremendous size coupled with great height, and the almost incredible contrast between the tropical half desert below and the alpine desert above. From a base about 80 kms. in diameter, the slopes rise very gently at first, and, gradually steepening towards the summit, produce that slightly concave outline so characteristic of Kilimanjaro and of strato-volcanoes generally, and indicating the fact that the earlier lavas have been poured out in a much more liquid state than the younger ones, which were more viscous. One cannot help being struck by the har-



Sketch-map to illustrate Mr. Gillman's paper on An Ascent of Kilimanjaro.

monious blending of majestic grandeur with almost delicate elegance of its lines. The vast dimensions in the horizontal sense are accentuated by an imposing height, for no other mountain can compete with Kilimanjaro in height as measured from its orographical base to the top. Many peaks of the world's big fold mountains, several volcanoes on the Central and South American plateaus are of course actually higher above sea-level than Kilimanjaro, but their base, be it a chain or a plateau, lies already at a considerable altitude, whilst here the slopes rise in an uninterrupted

line 5200 metres above the surrounding plains (800 metres) to the summit of Kibo (5930 metres).

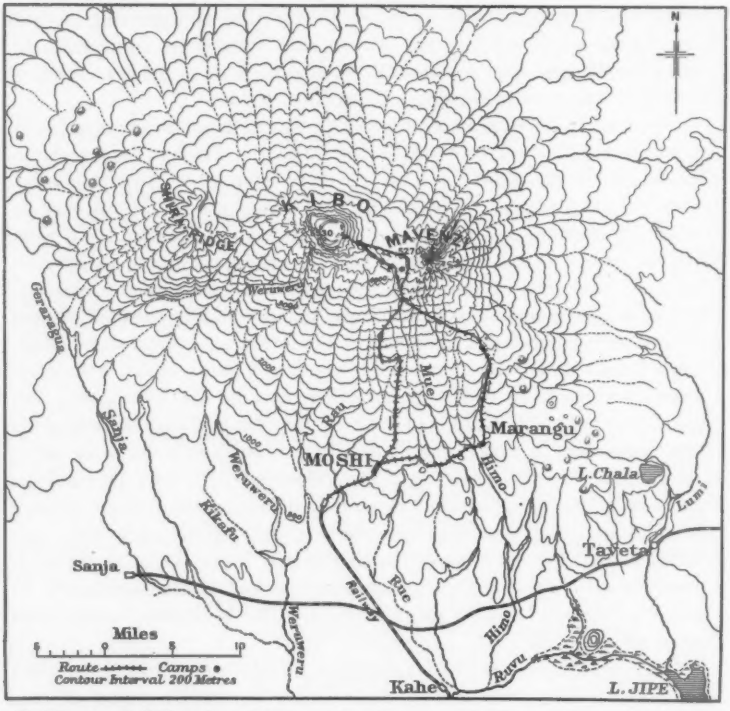
To this grand form must be added the effects of contrast: Contrast in age, in geological structure, in surface morphology, and in climate. The ground one stands on bears all the marks of old age. A slightly undulating peneplain, buried in layers of red lateritic soil, the worn-down foundations of a very old continent, wind-swept and dry, almost a desert. And over there, almost within reach of one's outstretched arm, new life that has sprung from the depth of the old crust, a youthful giant basking in the sun, scarcely touched as yet by the levelling and grinding tooth of time, reaching high up into the vapour-laden atmosphere from which he draws the life-spending moisture which enables him to wear a crown of silvery ice and to wrap his slopes in verdure.

Structurally Kilimanjaro consists of three single strato-volcanoes, each of which has had its own origin and history. Through mutual interbedding of the lava-flows, however, all three have grown into one solid, complex strato-volcano. The three cones whose centres of eruption lie on an almost straight line running west to east, are Shira in the west, Kibo in the centre, and Mavenzi in the east. Shira, the oldest, 4000 metres high, is to-day only a ruin with the remains of its former crater-wall forming a ragged more or less horizontal spur protruding from the western slope of its neighbour. The second in age is Mavenzi, 5270 metres high, whose former crater, though much destroyed by erosion, is still well recognizable and opens by two deep barrancos towards the north-east. The centre is taken up by Kibo, 5930 metres, the youngest and highest of the three component volcanoes, and the only one which still shows an intact crater and a perpetual covering of ice. Between Kibo and Mavenzi lies the so-called Saddle Plateau at an altitude of 4400 metres, and a number of radial zones of secondary peripheric eruptions diversify with their countless small parasitic cones the middle and lower slopes of the main massif. One of these cones, right down at the foot of the mountain in its south-east corner, has a large crater filled by the beautiful emerald-green waters of lake Chala.

The climatic features of Kilimanjaro are determined by three main factors: (1) the mountain's position in the equatorial region of continuous trade winds; (2) the isolation of a huge mass of rock rising from a level plain; and (3) the great height above this plain which brings the upper regions of the mountain well within the zone of the anti-trades.

Both trades bring a certain amount of vapour from the Indian Ocean, the south-east much more than the north-east, which is blowing over a much larger extent of land before it reaches Kilimanjaro. But as soon as they approach the mountain they become subject to local modifications due to the great isolated mass rising suddenly from the plains. The results are ascending winds during the day and descending winds at night, the mountain winds being stronger over the southern than over the northern

slopes, because the former, being less steep than the latter, are more extended and therefore the air-column influenced by them much larger. It is these mountain winds which, by altering the horizontal direction of the trade as it strikes Kilimanjaro, govern the daily cycle. The details of this cycle, and their changes with season and locality, have been very elaborately dealt with by Klute. His investigations show that the climatic elements are not, as might be supposed, a simple function of altitude. And their variation is further complicated by the forest belt, which forms



Sketch-map of Kilimanjaro, based on the 1/50,000 map by Klute and on the 1/300,000 map of Sprigade and Moisel.

a sort of battle-ground for the differing climatic zones below and above. In this belt the rainfall reaches its maximum and then rapidly decreases with increasing height.

The change of climate from the semi-desert type at the foot, through tropical and temperate types on the middle slopes, to arctic conditions in the highest regions, is well illustrated by the superposition of typical forms of vegetation which encircle the mountain in more or less horizontal belts. So striking are these belts, and so well discernible even

KIBO FROM THE ALPINE MEADOWS ON THE SOUTH-EAST

KIBO FROM THE SADDLE PLATEAU

KILIMANJARO FROM THE NORTH-EAST

Phot. Hon. C. Dundas.

MAVENZI AND THE SADDLE PLATEAU FROM THE CAVE ON KIBO

Phot. Hon. C. Dundas.

from some distance, that already in 1855 Bayard Taylor alluded to them in his noble ode on Kilimanjaro. These five zones are the following:

(1) In the surrounding plains and on the lower slopes up to 1100 metres, xerophile grass- and bush-steppe.

(2) From 1100 to 1800 metres, a broad belt of agricultural land from which the original vegetation—lower tropical rain-forest—has been largely exterminated by man. The rainfall averages 1 metre.

(3) The forest belt between 1800 and 3000, with its two subdivisions of upper tropical rain-forest and temperate mountain rain-forest, and an annual rainfall of from 2 to 3 metres.

(4) The alpine grass and shrub vegetation from 3000 to 4400 metres, with a rainfall of less than 1 metre; and finally,

(5) The alpine desert, where lichens are the only plant form that can subsist, on the whole extremely dry and with all precipitations falling in the shape of snow or hail.

With the exception of a little, probably permanent, patch of névé on the south-west slope of Mavenzi, all present-day glaciers are found on Kibo. The form of glaciation is that of the "Glacier-cap," a very distinctly characterized type which—according to Jaeger's and Klute's lucid investigations—is neither due to the mountain's position in the tropics, nor peculiar to an ice-clad volcano. It will form wherever a massive, little-dissected isolated mountain rises above the snow-line (Jaeger, *l.c.*, p. 165). Mount Kenya, which is also an isolated mountain but is much more broken up by deep valleys than its great neighbour, has no glacier-cap but hanging glaciers of the common alpine type. The characteristics of the glacier-cap, which thus represents a type quite independent of geographical position or meteorological conditions, and is only due to topographical form, are a snow or névé cap above the snow-line (area of feeding) and an ice-belt below the snow-line (area of fusion). According to the prevailing conditions of snowfall, insolation, and declivity, both snow- and ice-line reach down to different altitudes in different parts of the mountain, with the result that, generally, the snow- and ice-cap rests obliquely on the top, and has a more or less sinuous border. The individual glaciers of the glacier-cap are divergent, *i.e.* they originate from a common névé-field, and tend to separate on the convex surface of the mountain. They are thus only badly nourished and melt high up on the mountain slope. The alpine type, on the other hand, shows convergent glaciers; on a concave surface the overflows from several névé-fields join, and the resulting trunk glaciers, fed from a comparatively large area, reach far down below the snow-line (Klute, *l.c.*, p. 121).

So much for the general type. Kibo, however, shows a peculiarity, unique as far as our knowledge goes, in that its large central crater forms an island-like region of fusion, interrupting the region of feeding, the

latter thus being of annular shape and enclosing a dischargeless glacier area (Jaeger, *l.c.*, p. 168).

It was during a hurried reconnaissance in January 1919, when Mr. C. C. Eccles and I had reached the Saddle Plateau, that, fascinated by the wonderful mountain, I had decided to attempt the climb. The party which left Moshi on 15 October 1921 consisted of the Hon. Charles Dundas, Senior Commissioner of Moshi, Messrs. P. Nason and F. J. Miller, and myself. The first day's march of seven hours took us through cultivated Chaga Land in an easterly direction to the little kingdom of Marang'u, which had supplied the porters for most of the former expeditions, and whence a good path leads through the forest belt. This march across the lower slopes of the mountain entailed a good many ups and downs caused by the deeply eroded radial valleys, but it also afforded us a fair insight into the life of a most interesting people. Nowhere in East Africa have I seen anything approaching the high standard of culture that is exhibited by the sturdy inhabitants of the cultivated zone of Kilimanjaro.

Grouped together in a number of little chieftaincies, the Wachaga are certainly a happy blend of the agricultural Bantu and the Hamitic herdsman. This is very probably due to the initiative of powerful and despotic rulers who, by imposing their will, led the masses to more intensive labour and thus to higher forms of civilization, and have understood how to make the best of the very favourable conditions which the well-watered mountain slopes offered. The staple food is that of all African mountain tribes, the banana, which is grown in dense groves surrounding the typically Hamitic beehive huts. Every plantation is fenced in by a well-trimmed hedge, and all are kept clean and tidy. The Chaga cattle are small but look very healthy. The custom of stable feeding, reported by the early explorers as universal, has fallen more and more into abeyance as a result of the pacification under European administration, which has put an end to the perpetual intertribal wars and the looting expeditions of the Masai from the plains.

But the impression of a high standard of culture is further strengthened if one studies the marvellously developed irrigation system. Thousands of pharos lead from the intakes high up on the mountain along the slopes of the ravines to the cultivated area, many of them requiring quite a considerable amount of earth-work, and others, carried in wooden pipes along perpendicular walls of rock, much engineering skill. At many places one counts five or six of these channels running parallel along a steep slope one above the other at distances of about 10 to 15 metres. The maintenance of these works is no small matter, either, and altogether one marvels at the economic work these mountain people have to perform daily. It must be noted, however, that all this labour is undertaken exclusively to water the Eleusine fields, the crop grown solely for brewing;

an instructive instance of the civilizing influence of that craving after intoxicating stimulants which seems to be one of the fundamental instincts of the human race.

As might be expected, a people living in so bracing an environment and occupied with hard but healthy work are well built, sturdy, and tough. To see their women balancing huge bundles of thatch descend along a steep and slippery path, slim and erect, is a fine sight. And as to the men, our porters gave a good exhibition of their staying power. Whilst we were gasping for breath they climbed ahead of us carrying our heavy kit; when we were shivering in our clothes on a soft mattress inside the hut they were laughing and chatting on the bare ground under the doubtful shelter of a thatched roof or a few sheets of corrugated iron. Whereas we tried to sustain our bodies with concentrated foodstuff they chewed a few half-done bananas, and hot tea and sugar which we had taken up for them was considered a luxury. During the whole tour they not only never gave us any cause for complaint but were a continuous source of admiration.

Two cooks, two guides, four servants, four askaris, and fifty porters formed our retinue as we left Marang'u in promising weather at 8 a.m. on the 16th, and against emergency we took a mule and a donkey as well as a herd of sheep as far as the Saddle Plateau. After 1½ hours across the open country of upper Chaga Land and 1¼ hours through the belt of tropical forest, we rested on the lowest patch of grass at about 2000 metres. A further climb of a little more than an hour took us through the temperate rain-forest to the lowest of Dr. Foerster's huts (2730 metres), which we reached soon after noon. As it was the driest season of the year the soil, fat brown clay, was not muddy and slippery, and the trees had already evaporated their surplus water, so that we were left to enjoy the advantages of the cool dark shade.

It probably requires the trained eye of the botanist to distinguish between the lower and upper tropical rain-forest. As far as I could see they both agree in their main characteristics, *i.e.* tall trees growing out into the light from a dense undergrowth, and large smooth shiny leaves adapted to a highly increased transpiration. Tree ferns become more abundant as one rises, and where there is room for it the ground is covered with a bright green carpet of Selaginella. Each individual tree, whether alive or lying as a decaying trunk across the path, feeds a whole colony of parasitic plants, chiefly lower and higher cryptogams. These parasites, especially lichens, increase in number and size as one enters the temperate mountain forest which is characterized by the absence of really tall trees. At about 2500 metres this forest is no longer continuous but breaks up into patches separated by luxuriant grass formation. In the forest patches the plants still stand as closely packed as further down, but it would seem that the climatic conditions in these altitudes are beginning to be too inclement to allow of that ease of life and luxury

which finds its expression in the choking vegetation of the tropical forest. The abundance of moisture with which the plants have to deal during most of the year up there in the mean altitude of the daily mists is aggravated by the comparative coolness of the climate. Mere enlarging of the transpiring leaf surface and the tropical devices for letting the water drip off no longer suffice. Other means had to be developed to deal with the altered environment. The leaves again become smaller and are often covered with thin hair, which, while allowing the surplus water to drip off easily, may also be regarded as protection against cold. The habit of this forest type shows at the first glance that we have left the land of ease, and that the plants up there have almost, if not wholly, as grimly to fight for existence as their brethren far down in the steppe: drowning and shivering here, scorched by drought and heat there. The uppermost portion of the temperate forest consists almost entirely of tree-heather growing to a height of 10 to 15 metres. A most curious fact, and one which requires further investigation, is the absence of that bamboo belt which is found everywhere in East Africa above the rain-forest and, according to Uhlig, is particularly well developed on Mount Meru, only some 80 miles distant from Kilimanjaro.

I wish to add a few words on the economic function of the forest belt. The agriculture of the Wachaga, and with it their further progress towards civilization, but also the development of the European plantations in the lower regions of Kilimanjaro, depend in the first instance on that continuous and ample supply of water which the mountain guarantees them. It seems, therefore, of the utmost importance to understand clearly the agencies which influence this life-spending element. A casual observer, seeing the large perennial streams break from the mountain and carrying life and verdure right into the desert-like steppe, is liable to connect this fact with the ice-cap of Kibo and to imagine that the glaciers form the reservoir which feeds the rivers. The actual causal nexus is not so simple, however. A closer scrutiny of the mountain's topography alone shows that such large streams as the Lumi, Himo, and Mue, springing as they do from Mavenzi, never come under the influence of Kibo's glaciers, and that, therefore, the theory of the glacier-fed streams is incorrect. The reservoir that, by regulating the discharge of moisture, is the real life-spender of the cultivated Wachaga zone and the cultural oasis of Taveta and Kahe is the forest belt. Its main functions are: (1) to condense the vapour which is brought by the Trade from the Indian Ocean and is carried up the slope by the daily ascending winds; (2) to store the condensed moisture in the thick sponge-like layer of humus formed and regenerated by the decaying masses of the luxuriant vegetation; and (3) to discharge these rich stores gradually in the form of springs which, in their turn, feed the streams.

But the meteorological conditions of the mountain are such that a considerable portion of the vapour-laden atmosphere reaches the higher

regions above the forest before condensation has taken place, and the same is the case with most of the moisture which the forest plants themselves exhale again in the course of their life process. A small part of all this moisture is carried away by the Anti-trades and lost to Kilimanjaro, but most of it is condensed higher up, and either returns direct from the grass-land or rocky slopes of Mavenzi into the forest region, or is stored in the ice-cap of Kibo. The latter doubtless forms an additional storage, but on comparing the small amount of moisture that ever reaches the sphere of influence of this reservoir with the vast quantities dealt with in the forest region, the insignificance of glacier storage becomes obvious. In addition to this, most of the water leaving the glaciers does not run straight into the plains, but on its course is absorbed by the humus of the forest, thus merely helping to increase the store of water contained in the latter. Thus it is the forest which forms the great life-spending reservoir and the glaciers cannot be said to be more than an auxiliary, secondary store-house, which deals with the waste from the main stores.

With these facts established beyond doubt, the policy of the responsible administrator, which should be guided by conditions of environment, is clearly marked out. It must consist in preserving the forest belt intact. If the increase of population in those healthy regions in the near or distant future should lead to a tendency of expansion, detrimental to the forest—and the first signs of this are already noticeable to-day—this will have to be counteracted by teaching the native a more economic husbandry. The high standard of culture reached by the Wachaga will, I feel sure, make this task comparatively easy. But whatever steps may be taken to deal with an increased population, in the interest of both black and white the forest must not be touched. Every further acre cleared up there means irrevocable distress further down in years to come.

Our third day's march, by which we covered 14 kms. and gained about 1000 metres in height, took us from the upper edge of the forest north-westward. Traversing the lower slopes of Mavenzi, crossing not less than ten radial valleys, some of them deeply eroded, and gradually rising to 3800 metres, we reached Dr. Foerster's highest hut on the upper reaches of the Mue–Rau divide in four hours. At about 3000 metres we passed a large herd of eland and two klipspringers. Boulder-strewn lava-fields descend from what looks like a ridge on the right but is, in reality, the edge of the basis platform above us. Mavenzi, which rises from this plateau, remains hidden behind this edge, except where, now and then, the gap produced by a deep ravine, having eroded backwards into the base, affords a short glimpse of the mountain's rocky cliffs and débris slopes. In January 1919 all the streams had carried much more water than this time, and I was surprised to see them so dry. For although we were at the end of the three months' dry season, Mavenzi had certainly had several heavy snowfalls during the preceding week.

We had left the last isolated patches of temperate forest behind us at

about 3000 metres, and found ourselves in the uninterrupted grass-land which is the dominating form of vegetation between 3000 and 3500 metres. Differences in the degree of moisture lead here, as everywhere else, to marked differences in the habits of an otherwise uniform formation. The ground between several parasitic crater cones is undulating, and swampy depressions alternate with dry ridges, which results in the tough grasses growing taller and closer together in the former and being more stunted in the latter. Flowering plants, too, are naturally more conspicuous in the well-watered valleys and of more modest and drought-resisting type higher up on the slopes. To the weary wanderer this subtle difference, which seen from some distance does not strike the eye, is well noticeable, as it forces him to stumble along as best he can through the more luxurious growth, whilst on the flat dry ridges walking is much easier and he can generally see where he puts his foot.

Gradually, however, this typical grass-land merges into the alpine scrub which covers the slopes from 3500 to 4400 metres. It is characterized by a number of shrubs, chiefly Erica and Ericinella, growing in a fairly loose formation and interspersed with cushions of tough grasses and immortelles. The higher one climbs in this rather monotonous vegetation the more one becomes impressed with its main characteristics, which are all due to protective adaptations against cold and wind in a comparatively dry climate. Stunted growth, deep-reaching long roots, and the tendency to spread the foliage as close to the ground as possible are the result of the very severe climatic conditions of this zone. Only where the steep banks of a ravine or a wall of rock afford a fair amount of protection from the icy winds, and where running or stagnating water increases the amount of available moisture, does one see other representatives of plant-life, partly old familiar types from Europe, but on the other hand, and dominating the scenery of these ravines, those grotesque children of the African high mountains, the tree Senecios. As one ascends the vegetation becomes scarcer and more stunted, but there are still plenty of immortelles and a lot of heather, about a foot in height, around the hut, and the large knobby roots of the latter were the only available firewood.

A steady north-east wind had been driving the thin sheet of clouds, which had filled the gap between Kilimanjaro and northern Pare in the morning, round the mountain until it got held up by the Shira ridge in the west. This resulted in an accumulation of clouds over the south-western slopes of Kibo, from which, when at noon southern and south-eastern ascending winds set in, thin films rose which hid the dome from our view until 4 p.m. No mists reached our hut or the Saddle Plateau, and the whole plain from Taveta to Moshi became visible. The main outlines of the immense area were spread beneath us like a gigantic map. The ridiculously geometrical surface of lake Jipe had become a silver speck, Chala in its crater a tiny yet still brilliant jewel.

In 1919 Eccles and I had felt great difficulty in breathing long before reaching the hut; our appetites had been shockingly bad, and we had been worried by continuous headache. This time all these symptoms were practically non-existent. I was able to move about freely, and spent more than an hour in the ravine below the hut, climbing about and swinging my heavy geological hammer; I enjoyed both meals thoroughly, and only for about an hour after lying down, when the requirements of the stove and of four tightly packed men were rather a heavy drain on the air inside the hut, did my head ache a little. My companions too suffered very little. I attribute this remarkable difference primarily to the fact that I was in much better training this time, and then to the strong wind which blew all day. There can, in my opinion, be no doubt that mountain sickness, which is due in the first instance to lack of oxygen, must—all other conditions being equal—be less felt when a strong air current carries larger quantities of the gas per unit of time to one's breathing organs, than when, in a stagnating atmosphere, the scanty available supply becomes quicker exhausted.

The weather had kept its promise, and a glorious dawn started the fourth day of our climb. From an endless sea of clouds on which the first rays of the sun produced an ever-changing play of golden light and purple shadows, our mountain island reached into a perfectly clear sky, with the two mighty peaks standing out from that curious blending of light created by the setting moon and the rising sun. And then, under the gentle kiss of the first golden rays, light mists emanated invisibly from the glaciers and, gathering in a silver ring of infinite fineness, stood for a few moments like a halo above the rose-coloured dome, to dissolve again as suddenly as they had appeared.

With considerably reduced baggage we started at 6.45 a.m. Those of the porters who did not carry loads took a large supply of firewood and four tins of water up to the cave, which is a long way beyond the upper limit of vegetation, and waterless, as at the end of the dry season one cannot, with certainty, count on remains of snow in its neighbourhood. Two hours' slow but steady climbing brought us to the Saddle Plateau between the south-west foot of Mavenzi and eastern Lava Hill. Kibo, our goal, stood before us only 9 kms. away, and across the flat plateau, at a distance of 6 kms., the lava cliff which contained the cave in which we were to spend the night was plainly discernible. It took us more than two hours, however, to walk those 6 kms., and we all knew at last that there was up here, after all, not quite as much oxygen as we were accustomed to. Shortly before reaching the cave I counted pulse 98 and respiration 22 per minute, in calm weather. The porters behaved splendidly and did not seem to suffer much, and the animals, except for fast breathing, appeared perfectly all right.

We passed a herd of five large eland, who, at an altitude of about 4500 metres, were nibbling a few stunted Helichrysum, the last repre-

sentatives of higher plant life. The animals, whose spoor and droppings we met with everywhere on the plateau, seem to be quite at home in these altitudes. A skeleton of one of them was bleaching on the sand, further emphasizing the great similarity of the scenery to that of the true desert—a similarity which automatically forces itself on the mind at every step, if only one shuts out from view the glaciers above.

And, indeed, this likeness of surface forms is merely the result of a series of causes which are as much at work on Kilimanjaro as in the Libyan desert. We are here, on the dry Saddle Plateau as well as higher up on the eastern and north-eastern slopes of Kibo, in a region of true desert weathering; that is to say, in a region where the mechanical disaggregation of a surface unprotected by vegetation is primarily due to insolation leading to desquamation, and where, by wind-deflation, the rock surfaces are swept clear of the smaller débris, and thus kept perpetually open to fresh attacks by the agents of dry weathering. The larger débris form talus and scree fields, spread out and washed down at intervals by floods to which the rapid melting of occasional snowfalls may give rise. Corrasion also, *i.e.* the carving up and smoothing down of rock surfaces by the mechanical action of sand-charged wind, leaves its traces everywhere in this region where rounded edges form a marked morphological characteristic.*

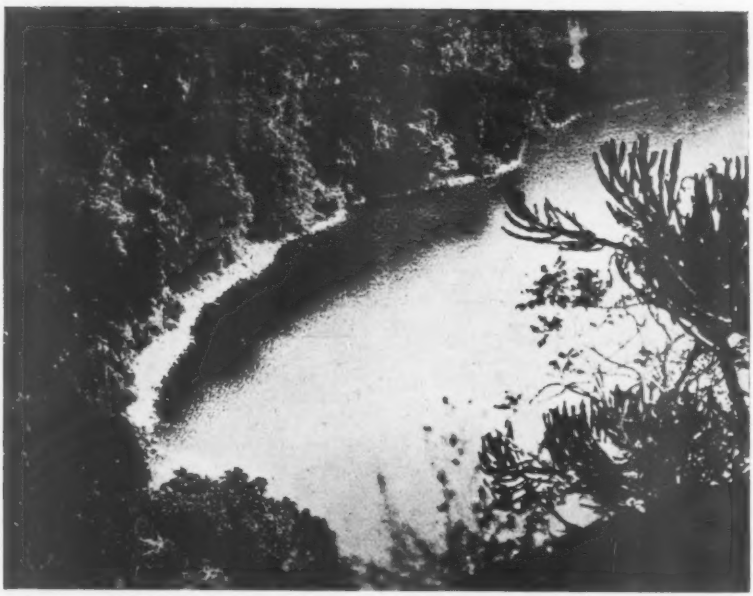
Thus the Saddle Plateau consists in reality of the much flattened-out débris cones which, flowing from the eastern slopes of Kibo, the western slopes of Mavenzi, and from the six plateau hills, meet on the saddle between the two main peaks, and have in the course of time buried the originally volcanic topography under a sheet composed of the finer produce of desert weathering. Towards the south this flat desert-like expanse is well bounded in by the just-mentioned plateau hills, towards the north it gradually merges into the steeper portion of the underlying lava base, whilst towards Kibo and Mavenzi, gradually increasing in steepness, it joins up with the large débris streams which almost entirely envelop the lower reaches of these mountains. It is doubtful whether glaciation on this side of Kibo ever reached far enough down for fluvio-glacial drift to have started the levelling-up process of the plateau. However that may be, the present surface is undoubtedly due to desert weathering, resulting in what de Martonne calls "desertic drowning" ('Géographie physique' (Paris, 1920), p. 667).

The desert type of mechanical weathering is naturally restricted to the driest parts of the mountain, where snow and rains are comparatively rare, and the great permeability of the surface layers combined with steep slopes effects an almost immediate and thorough drainage. Where, on the other hand, the moisture of air and rock increases—that is, generally speaking, above the snow-line—the destructive element of interstitial frost enters into competition with and soon prevails over pure insolation:

* Dr. Meyer denies this, *vide* 'Der Kilimandjaro,' p. 149.

THE CRATER OF KILIMANJARO AND CENTRAL CONE FROM JOHANNES NOTCH

NORTHERN EDGE OF THE RATZEL GLACIER



LAKE CHALA, KILIMANJARO

Phot. Hon. C. Dundas.

we enter the region of typical frost weathering which is the common type of mechanical disaggregation on high mountains and produces jagged forms and accumulations of angular débris. It is obvious that both types of mechanical weathering should gradually merge into one another as one climbs from the saddle and over the lower slopes of Kibo into the neighbourhood of the ice-cap. But it is important for a correct understanding of the surface forms to insist, with Dr. Jaeger (Jaeger, *l.c.*, p. 139) on this distinction between desert and frost weathering, a point which obviously escaped Dr. Meyer. His term "alpine desert" is somewhat too vague, and should, in my opinion, be restricted to the zone of real alpine, *i.e.* frost weathering, whilst "mountain desert" might appropriately be employed for the true desert produced at high altitudes by dry weathering under the influence of insolation and wind only.

Whilst on the subject of weathering it should be noted that the rounded form of the blocks of all sizes, with which the ridges formed by old lava-streams are everywhere strewn, is not purely due to weathering. In many places comparatively fresh exposures of prevailing basalt show a distinct spheroidal structure of the lava, so that the loose blocks appear to be merely the original spheroids separated by progressive weathering along their surfaces. Jaeger (*l.c.*, p. 123) reports similar forms from western Kibo.

At 11.15 we stood at the cave (4610 metres), and after a short rest, during which a slight headache soon disappeared, we climbed the lava wall immediately behind the camp to reconnoitre. Protected by rocks rom the north-east wind and basking in the bright sun, we could study the slopes now only 1 to 2 kms. distant. The first glance confirmed me in my opinion that technical difficulties of any description need not be anticipated, and all I had to do was to look for a route which promised the least possible strain on lungs and limbs, and to obtain sufficient grasp of the topographical detail to enable me to get back to the cave in case bad weather were to overtake us. That done, we were free to enjoy the peculiar beauty of the scenery before us. Across the vastness of the stone desert, so fascinating in its lifeless monotony, the eye wandered to the crown of ice which separates the brownish-yellow hues of rock and scree from the clear blue sky above. Even from this distance the gigantic pillars and arches of ice into which the perpendicular glacier walls break up were plainly visible. Ratzel glacier, whose ice masses, seen under a very steep angle, seemed to reach further down than they actually do, dominated the landscape.

And on looking back across the Saddle Plateau I was surprised by the great beauty of Mavenzi. So far I had looked upon this minor peak as interfering, to a certain extent, with the noble outlines of the mountain, and I still maintain that, seen from the plains, Kibo's ice-dome would gain without his little black neighbour spoiling the even curve of its eastern slope. But up here, just at the right height and right distance

from its foot, not too far to miss detail and yet far enough to be impressed by its rocky mass as a whole, I must confess that Mavenzi is a mountain well deserving of admiration. Its beauty is akin to that of the Dolomites—the same towering pinnacles, the same jagged outlines and the same variety of colours playing on its weathered face; only everything on a larger scale, wilder if possible, and without that setting of verdure which forms so vital a part of the charms of the southern Tirol.

The air temperature was only 12° Centigrade, but the radiation from the soil 30·5° when, soon after 12 o'clock, we sat down to quite a substantial meal with practically unimpaired appetites. The bulk of our porters had been sent back with the animals to the upper hut, and the fifteen men who remained, well equipped with foot-wear, three blankets, and an overcoat each, were cheerfully preparing for the cold night which, for some mysterious reason, they preferred spending outside the cave. Only one of the askaris seemed to suffer seriously from mountain sickness; the others were roasting large chunks of mutton over a smoky fire, and brewing a disgusting concoction of bananas and ghee. Slowly the shadow of Kibo crept towards us, passed us, and moved on over the plateau, and whilst Mavenzi was still bathed in warm red light the thermometer with us had already dropped below freezing-point, and shivering we retired into the cave.

A few huge lava blocks have tumbled down in such a manner as to form a fairly large sloping cavity, which one enters by a low funnel-shaped mouthpiece; but though this shelter protects one from the nightly glacier winds, it is a draughty and most unpleasant abode, which, in addition, becomes smoky as soon as one attempts to light a fire. Nevertheless I soon fell asleep in my soft, warm sleeping-bag, and had five hours of practically undisturbed rest. We awoke at midnight, all suffering from headache. But as soon as at 2 a.m. I stepped into a brilliant moonlit night and breathed the cold crisp air the headache left me. The weather was perfect, and the air temperature when sheltered from the glacier wind only 2° below freezing-point; the stars shone with wonderful brightness, our way lay before us in the white moonlight, and everything promised success. Nason, who felt very sick, turned out soon afterwards, declaring he was quite prepared to go. At 2.30 we started.

In the wide lower valley with its comparatively small and well-packed débris we got along at a fair pace, and though a bitterly cold wind was now blowing straight down on us the hard work kept us sufficiently warm. Miller, who was suffering from a chill, had to give up at about 4900 metres. Soon afterwards we entered the first tributary valley from the left, where the scree became much larger and the slope so steep that we had to adopt a zigzag course from wall to wall, and our progress became slower and short rests more frequent. Unfortunately, at about 5200 metres Dundas too had reluctantly to give up, as the strain on heart and knees proved too great. We left him with the older of the two

natives who had volunteered for the final climb, and who, though he did not complain, looked very cold and miserable. We now turned into a minor and much steeper valley that came down from the right (south-west), where the work became much harder than I had anticipated, chiefly because the failing light made orientation very difficult, and it was not always possible to spot the easiest route. We kept to rock as much as possible, and at 5.15 stood, at last, on the rocky ridge which we knew led right up to the crater rim. A longer rest had become imperative and, crouching close under a rock to get some protection from the icy wind, we awaited the rising sun. To say that, physically or mentally, I was in a fit state to enjoy the glories of the dawn would be untrue; but I have vague recollections of an endless sea of rosy clouds far below, of Mavenzi's black silhouette standing out from a background of glittering gold, and then suddenly of gigantic rays shooting up. With regained strength and good hard rock under our feet we climbed the next 200 metres in an hour. But soon the rock became so brittle that I had to abandon my plan of reaching the crater over the lava ridge. We had only one choice: to take to the screes which lay between the ridge and the perpendicular walls of Ratzel glacier, obviously the former bed of a now disappeared northern lobe of that glacier. Old moraine stuff and the more recent débris of the crumbling ridge formed a slope of 30° to 35°, up which we slithered and pounded for more than two hours.

At 8 a.m. our second native companion had come to the end of his strength; overawed by the ice-wall which was now close at hand, he lay down and refused to move further. As the weather was safe we could calmly leave him at about 5700 metres. Nason and I crept on alone, but our progress became slower and slower. The ratio of rest to climb amounted to something like 5 or 6 to 1. This was getting too slow, and I saw that, with respiration at 35 and pulse at 120 to 130 per minute, we could not last much longer. In addition, Nason was sick at regular intervals. With every step upward we slid back more than half the height gained. Our triangular scree slope had narrowed down to about 200 metres; on the right we had the crumbling cliff over whose jagged rocks progress seemed out of the question; on the left, however, the perpendicular side of Ratzel glazier gradually merged into a shape which, though still very steep, was more convex and permitted to get on to the ice. The only hope lay in that direction, and though Nason was nearing exhaustion, we had to try. He responded splendidly. A few more steps over those hateful screes and across the little glacier stream that skirted the ice, and my old ice-axe came down for the first time. The slope was in the neighbourhood of 40 degrees, but the demoralizing sliding back had ceased, and I knew instantaneously that everything was now all right. The psychological factor of doubt disappeared, and with its disappearance strength immediately returned. At 9.45 we stood at last on the crater-rim. Bathed in light Kibo's vast crater lay at my feet, with its walls and

battlements of ice, white and blue, in mighty solitude under a sky of steel. A few rags of cloud passed over the plateau and tore up the slopes of Mavenzi, which now looked like a molehill far below. And as wide as the eye could reach the great continent was hidden beneath a continuous veil of mist. Only far away to the north a heap of cumuli rising from the seemingly uniform level of the cloud sea indicated the position of Mount Kenya, the brother giant.

Nason was almost completely exhausted, and though he somewhat recovered after an hour's rest, it was, unfortunately, quite out of the question to take him to the highest part of the rim, about 1½ kms. distant. For the same reason, my hope of reaching the central cone inside the crater to investigate its composition was frustrated. Thus we deposited the Union Jack on the needle-shaped rock which protrudes from the great notch in the eastern ice-wall, and which on the German maps is called "Johannes Scharte." The flag, according to my observations, now lies about 100 feet below the actual summit. I had, for the first time, carried a boiling-point apparatus to the top of Kilimanjaro, and determined the altitude of Johannes Notch (at the foot of the protruding rock) as 5880 metres; this fits in well with the figure given on Dr. Klute's map for the summit (5930 metres), a figure arrived at by extrapolation from a photogrammetric survey. At 10 a.m. the temperature of the air was 3° C. above freezing-point, and that of the rock 8°.

With regard to mountain sickness our experience once more brings out the importance of the personal element, *i.e.* the fact that with the same outward conditions the physical fitness of the individual climber decides the degree to which he is affected. With the exception that our mouths were never parched (as described by Meyer and Uhlig), we experienced, on the whole, the same difficulties, both physical and psychological, revealed by all former climbers, with the exception of Mr. West, who, according to his own description, walked from the cave to the crater-rim with the greatest ease (*Cape Times*, 21 April 1922). I attribute this to the fact that, ascending at the time of maximum snow, he had a hard frozen surface to step on, whereas all others, including ourselves, had the nasty volcanic scree to cope with, very similar, it would seem, to that described by Sir Martin Conway ('Mountain Memories') from Aconcagua. If ever I climb Kilimanjaro again I shall, therefore, ascend from the west, where snow and ice reach much further down.

As already stated, Kibo crater, 2 kms. in diameter and 200 metres deep, is the only existing instance of a dischargeless glacier basin. But in this connection it is noteworthy that in 1889 a large ice-stream ran from the crater through the deep western gap in the rim, forming a connection with the great Weruweru glacier, which shows that the present dischargelessness is a transitory, very probably periodically recurring stage (Jaeger, *l.c.*, p. 171). Uhlig (*l.c.*, p. 636) reported a temporary increase in 1901 as compared with 1898, but in 1906 Jaeger and again in

1912 Klute definitely stated that a connection between the crater ice and the Weruweru glacier no longer existed. The most obvious cause for the undeniable fact that, at present at least, fusion inside the crater prevails over feeding is the intense insolation combined with radiation from the large patches of bare rock; though it is not improbable that the last remainder of internal volcanic heat may have something to do with this remarkable phenomenon (Jaeger, *l.c.*, p. 169).

Most of the water produced by the melting of the ice immediately evaporates in the very dry atmosphere, and the remainder mostly percolates into the permeable débris-covered soil, which accounts for the insignificant size and length of such small glacier streams as spring from the sides and snouts of the ice-streams. Inside the crater, near the foot of its south-eastern wall, I noticed three small circular ponds with a perfectly horizontal surface of ice and which looked like little skating rinks.

At the time of our ascent Kibo was quite free from fresh snow, which enabled me to study the striking surface forms of the ice, a dense network of deep furrows, following the natural slope, and being due to the erosive action of the comparatively warm water produced in large quantities under the direct influence of a powerful insolation. In the ridges which, often very narrow and sharp-edged, remain standing between these erosive furrows, the bond of the ice-granules seems loosened, the surface becomes crusty and, being air-filled, is of snow-white colour. This, together with the entire absence of surface moraines which can, of course, not form on a glacier-cap situated above the rock, is the reason for Kibo's perpetually glittering ice-dome, which looks pure white also when there is no trace of snow. With the exception of the lower layers, which are of beautiful blue colour, the ice on Kibo looks to me more opaque and whiter than that of alpine glaciers. This texture and the preservation of the original layers right down to the end of the glaciers are further characteristics of the glacier cap, and are easily explained by the properties of this type of glaciation: the short distance from the névé line to the end of the glacier lobes, which prevents a thorough transformation from typical firn into typical large-grained ice; and the absence of lateral pressure which, in the long alpine valleys, leads to final foliation of the original strata. The original stratification and the gradual merging from pure white névé into bluer and bluer glacier ice are wonderfully clear on the great perpendicular ice-wall on Johannes Notch, which with its unbroken height of nearly 60 metres forms a most instructive outcrop. Such perpendicular walls are a further most striking characteristic of the glacier-cap. As they occur everywhere on surfaces of nearly even inclination they cannot be identical with the ice-cliffs which, in the Alps and elsewhere, one observes above steep rock walls from which the overhanging ice breaks off, and which therefore are due to gravitation only. The ice-walls of the glacier-cap seem to be a peculiar form of melting, as

explained by Jaeger and Klute.* I have not come across "penitentes," and am thus unable to shed further light on the question, still much debated, of the origin of that curious surface form.

Getting on to the screes as soon as possible and glissading down on and with them, we retraced more or less our route of ascent, and reached the cave at 1 p.m., *i.e.* less than two hours for a distance that it had taken us nearly 7½ hours to climb. We found Dundas and Miller fairly recovered, but decided to spend another night at the cave in order to give Nason a thorough rest. He had suffered very much for more than ten hours, and had it not been for his splendid perseverance I would probably never have seen the wonders of Kibo; for I do not believe in climbing alone at such altitudes over unknown ice.

On the following morning, when descending to the upper hut, I chose the way across the five western plateau hills (the sixth I had already climbed in 1919). In an almost mathematically straight line, indicating a former rent along the direction of maximal volcanic activity which joins the summits of Kibo and Mavenzi, these six hills form the southern border of the present Saddle Plateau, and Dr. Meyer's suggestion that they were heaped up from one or several small local centres within the mass of the main mountain, at a time when the main energy had already spent itself, seems correct. They thus represent one of the last phases of Kilimanjaro's volcanism, and form one of the many zones of parasitic cones with which the parent mountain is studded (*l.c.*, p. 326). From Western Lava hill I partly followed and then traversed the eastern slope of the little valley which starts between Eastern and Western Lava hills on the edge of the plateau and runs in a north–south direction, without seeing any trace of the two great moraines shown on Klute's map. The valley is bounded by mighty lava-streams whose surface weathers into small and large rounded blocks, and which in my opinion cannot possibly be mistaken for moraines.

At 1 p.m. we started our descent due south, and reached Johannes hut on the upper edge of the forest above Moshi at 3 p.m. This descent, which leads down several valleys over very rough ground, is highly interesting to the geologist as well as to the botanist. When leaving the hut early the next morning I was greatly attracted by its surroundings, a region where the forest, dissolving into numberless patches, merges park-like into the meadows, and where Kibo's ice-dome forms so imposing a background to a landscape whose details, in form and colour, are most delightful in bright sunlight. During most of the year, however, this zone is enveloped in clouds, when, of course, its pleasing aspect gives way to the most dismal scenery imaginable. We had decided to take the much overgrown path straight down into Moshi, but about one hour from the hut, after having crossed two little streams and picked purple-flowered lobelias on little forest-surrounded meadows, we lost our way in the forest. We pushed on as best we could, making use as much as possible

* Jaeger, *l.c.*, pp. 183–186; Klute, *l.c.*, p. 118.

of the many elephant tracks. But it was damp and unpleasant in the fog, and we were glad when at last we struck a footpath which, after a long détour and a rather disheartening climb of more than 2000 feet, landed us finally above Moshi. Here we rested on the lower edge of the forest in the narrow bracken zone above a great gorge, enjoying for the last time the bracing mountain air and the wide glorious view before we were once more swallowed up by the dust and heat of the steppe.

A comparison of our photographs, taken from the cave and from further west on the plateau, with Meyer's views of 1889, doubtlessly proves the continuation of a period of shrinkage of the glaciers already noticed by Meyer in 1898 and emphasized by Jaeger in 1904 and 1906. Johannes notch, which in 1889 was still covered by a high and uninterrupted ice-wall, and was only a narrow gap in 1898, now forms a distinct breach in the ice-wall of the crater rim. Meyer notch, further north, though not quite ice-free, shows marked signs of further widening; and at a place approximately 400 metres further north, where the photographs of 1889 and 1898 show no trace of melting, the ice rim now looks much broken up and indented as if a new notch were forming. Ratzel glacier too has undoubtedly retreated since 1889. On Meyer's map, the accuracy of which just at this spot cannot very well be doubted, seeing that the explorer's route lay right across the glacier, the central part of the glacier, *i.e.* the one running into the south-east valley, is shown as reaching furthest down, whereas it now certainly ends further up than the great western lobe. As regards the crater ice, Uhlig's remarkably fine photograph of 2 August 1904,* taken from a spot only 40 to 50 metres south of the point from where I photographed my panorama, lends itself very well to a comparison and shows: (1) the almost entire disappearance of the last connected ice patches on the central cone, and (2) the entire disappearance from the inner wall of the north-western rim where seventeen years ago large areas were still ice-covered. These defects are too large to be considered as mere seasonal variations. Summarizing all these facts one can safely state that the period of shrinkage which began in the 'nineties is still continuing, and that the shrinkage is smallest in the south-east, gaining in extent in the east, and reaching its present maximum in the north.

Whether, as seems highly probable, this reduction is merely a phase in a comparatively short cycle of fluctuations coinciding with a minor climatic period or not, it can by itself shed no light on the much more important question of the maximum extent of glaciation during the pluvio-glacial period. For the western and southern slopes of the mountain Meyer's, Jaeger's and Uhlig's careful researches have established what may be considered a fairly accurate line of demarcation, but in the south-east, east, and north-east we are still very much in the dark regarding

* Published in Jaeger, *l.c.*, Plate 21.

the lower limit of the former ice-cap. That the débris mound which runs across the south-east valley at about 4700 metres altitude is a true old terminal moraine of the Ratzel glacier there can be no doubt. But lower down, at least in my opinion, definite proof of glacial action is missing.

Meyer sees in the débris masses of the southern continuation of the same valley ancient lateral moraines, speaks of *roches moutonnées* and erratic blocks on the north side as far down as 4100 metres, and even produces a polished block with marked striation from a spot at 3600 metres "where polishing by wind or water seems quite out of the question" (*l.c.*, pp. 129, 132, 373). Klute goes even further, and covers his otherwise excellent map with large moraines reaching down to 4000 metres on the southern slopes of both Kibo and Mavenzi. Jaeger, on the other hand, thinks it very doubtful whether the glaciation of eastern Kibo has at any time reached much further down than to-day, and with Uhlig prefers to see in the rounded forms and ruts and grooves on the rock surfaces the effects of desert weathering and wind corrasion, and in the débris masses which fill the valleys and cover the slopes the sliding-down produce of mechanical weathering rather than glacier-carried moraine stuff (*l.c.*, pp. 191–2). With this controversy in mind I naturally looked out most attentively for forms which might have decided the argument one way or the other, but must confess that I have been as unsuccessful as my predecessors in finding unquestionable proof. It is of course easy, in a region which is or has been subjected to desert or glacial action with their so closely resembling final forms, to see what one wishes to see and thus, subconsciously perhaps, to exaggerate. We have all the more reason, therefore, to be most particular regarding any observed fact which might be explained either way. But at whatever conclusion one arrives, so much is certain, that a doubtlessly long-continued period of purely mechanical weathering, both in its alpine and desert forms, such as we find it to-day in the area under consideration, has almost entirely obliterated all but the most prominent surface forms of a bygone period, and that, consequently, the task of determining the lower limit of a former glaciation is well-nigh impossible.

With these reservations I give the three points which in the course of our expedition struck me as being worth recording:

1. In the valley leading from the upper hut to the Saddle Plateau we found at the foot of the great lava-wall which runs southward from Eastern Lava hill, at an altitude of approximately 4300 metres, a large partly embedded rock, which showed three or four deep ruts running in the direction of the valley. Where and as it lies to-day wind corrasion must be excluded, but—and it is a large "but"—the block may have rolled from the cliff, which is only 70 to 80 metres distant, and may thus have received its ruts in a position high above its present resting-place where wind action is quite feasible.

2. The little valley between Eastern and Western Lava hill ends

quite suddenly on the edge of the Saddle Plateau in a well-rounded steep little amphitheatre, which, again, may without undue stress be taken for a glacial cirque. But here again the possibility of a purely erosive cirque formed at a much moister period, or desert erosion of the Wadi type, may be called in to explain the existing forms.

3. The upper portion of the débris valley below Johannes notch which, bounded by the main lava ridge in the north and by the north-eastern lobe of Ratzel glacier in the south, was the source of so much toil during our ascent, makes quite the impression of having once been glacier-filled, though I have nowhere seen definite traces of moraines, either terminal, lateral, or bottom; and I do not hesitate to state that the narrow lava-ridge was formerly the edge of the glacier at least down to 5000 metres—that is to say, that Ratzel glacier once pushed a third northern lobe into this valley.

And if this is correct there is no reason to deny that the ice-sheet, which at present only just covers the eastern rim, has at the time of maximal glaciation sent similar short lobes into the adjoining eastern débris valleys. All the more so as their steepness easily explains the absence of terminal moraines, the material of which could never have accumulated to any appreciable extent, but must have participated in the general downward movement of the débris stream as soon as it left the snout of the glacier.

In summing up my own impressions, I thus come to the following conclusions: While no definite proof has so far been forthcoming, or will ever be likely to forthcome, of eastern and south-eastern glaciers having at any time reached down to or below the Saddle Plateau, there is every reason to believe that at the time of maximal glaciation the present ice-cap extended a considerable distance down into the upper reaches of the eastern débris valleys.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: This evening we are to have an account of an ascent of Kilimanjaro which was made by Mr. Gillman about a year ago. Unlike the highest mountain in Asia, the highest mountain in Africa has been climbed more than once, and Mr. Gillman does not claim, therefore, that he has achieved any new records. Nevertheless, the story of his ascent bids fair to be one of great interest, especially to those who, like Mr. Gillman, are attracted by geomorphology, that branch of geology which overlaps the science of geography and which has been appropriately called the science of scenery. It was, indeed, the wonderful scenery of Mount Kilimanjaro which first attracted the attention of Mr. Gillman and which led him to escape for a short time from his onerous duties in connection with the Tanganyika railway system in order that he might attempt the ascent. From the point of view of the climber, the outstanding characteristic of Mount Kilimanjaro appears to be the fact that it rises from a level of little more than 2500 feet straight up from the plain to its summit at an altitude of nearly 20,000 feet. In this respect, indeed, I believe that Kilimanjaro is supreme amongst the mountains of the world, and it must be quite obvious also that in such circumstances it provides no opportunity for that acclimatization upon which the

climbers of Mount Everest laid so much stress. It does impose, therefore, upon the climber a proportionately greater strain. But of this and of many other interesting matters Mr. Gillman will himself tell us. I do not propose, therefore, to stand longer between you and him, but will call upon him now to give us his account of the ascent.

Mr. Gillman then read the paper printed above, and a discussion followed.

Sir HALFORD MACKINDER: I need hardly say that I have listened with the very greatest interest to the lecture which has just been given to us. Naturally, my ideas have been bent on the similarities and dissimilarities between Kilimanjaro and Kenya. Mr. Gillman was very fortunate in being able to see from Kilimanjaro the cloud cap on Kenya. I tried from Kenya to see the cloud cap on Kilimanjaro, and was not so fortunate. May I carry you back to the late summer of 1899, when I pitched my camp on the open plain where now stands the town of Nairobi? There were then no houses there. In the early morning I was waked by my two Alpine guides, who rushed into my tent in a state of intense excitement, crying, "Monsieur, les montagnes!" They had expressed no astonishment at anything all the way from the Alps to East Africa, but at last they saw the snows again. And I went out of the tent, and there in the clearness of dawn, 100 miles away to the south, was the great white dome of Kilimanjaro; and 100 miles to the north, the twin glacier-streaked pinnacles of Kenya. Kilimanjaro and Kenya are 200 miles apart; the equator goes through Mount Kenya, and Kilimanjaro is about 3° south of the equator.

The two vast extinct volcanoes are very similar in many respects. They cover about the same area of ground—each of them covers about the space of the county of Kent—and on their eastern sides they tower up from levels about 2500 feet above the sea. On their western sides, and especially to the north-west, they have higher plateaux adjoining them. The two mountains differ in this, that while they are both due, in the case of Kilimanjaro to three in the case of Kenya to two, volcanic vents placed west and east of one another, Kilimanjaro is much the more recent mountain, speaking orographically. It still retains its crater, more or less complete, with a cap of ice placed upon it. But Kenya has been dissected. It is orographically older. Not only have you no névé on the top, but all the crater ring has disappeared; the weather has torn the mountain down and there has been left upstanding from the western vent what is known as the neck of a volcano. The last lava hardened and crystallized in the throat of the volcano into syenite or granite, and then the weather tore all loose material from around it, with the result that this hard core of the mountain was left standing up like a tooth out of a gum. Kenya, therefore, is a dissected mountain, and, as our lecturer has told us, you have there Alpine valleys, deeply trenched into the mountain, and the glaciers are of the normal Alpine type; each glacier descends into its appropriate valley and ends below in a snout with a stream going from it. I think the two mountains were originally of about the same height.

With regard now to the climatic differences. Apparently on Kilimanjaro, at any rate as approached from its southern side, there is no bamboo zone. The bamboo zone of Kenya extends from 9000 to over 10,000 feet. It is several miles through, and the bamboos are very big ones, as much as 40 feet in height; the whole great thicket is traversed by elephant paths. The elephants feed on the green shoots, and you can hear them all around you.

The next thing I noticed in our lecture was that the Senecio, or the giant groundsel, and also the giant lobelia, were, in the pictures shown to us, mixed

with the upper edge of the forest; whereas on Kenya you go right out of the forest and some way through the zone of bush heath before you reach the great valleys which are studded all over with thousands of giant groundsel and giant lobelia.

Then, thirdly, there is no desert area on Kenya. You get domed bushes of heath, standing about 2 feet high, with rat paths between them, and that vegetation extends up to within a few hundred feet of the ends of the glaciers. Of course the arêtes which separate the glaciated valleys are of bare rock, but that is chiefly due to their steepness and the character of the rock.

Those three circumstances: the absence of the bamboo zone, the presence of a quite distinct and very marked belt of giant groundsel and giant lobelia, and the absence of anything that you can describe as a desert area, clearly indicate a very considerable difference in the upland climate of Kenya as compared with Kilimanjaro. The weather, however, seems to be compacted of the same elements in the case of both mountains. In the case of both mountains you have the south-east wind and the north-east wind striking at different times and places upon the lower slopes, and you have the anti-trade wind on the upper slopes. You have also the upward sweep of the day breezes from the plain towards the summit and the descent of quiet night air. You have the most beautiful displays of cloud on Kenya towards mid-day as the mist and snow are carried whirling round the peaks by the interaction of these various winds. The air from the valleys is shot suddenly up into the upper wind, and great curling masses of cloud form most beautiful objects and are a source of persistent interest to any one living above the forest.

I drew your attention just now to the fact that Kilimanjaro is about 3° south of the equator and Kenya has the equator passing through it. That belt of the two or three degrees south of the equator appears to be where the south-east and north-east trade winds meet, and I cannot help feeling that we might learn a great deal from high-level observatories on these two mountains. Nothing but the residence of properly qualified persons for a considerable period, certainly for two or three years, would enable us to get all that it seems to me might be got from the comparison of these neighbouring but contrasted mountain climates.

With regard to the glaciers, those on Kenya come down to a little lower than 15,000 feet. I found distinctly glaciated surfaces about 1000 feet below that. That was in 1899. According to the view just expressed to us, the shrinkage of the glaciers had already made a certain amount of progress by that time. I was struck, in the maps shown in this hall last spring (as the result of recent expeditions to Mount Kenya), with certain differences in the length of the glaciers as observed by the recent visitors to the mountain and the glaciers as I observed them. The variation was not uniform. Certain of the glaciers had lengthened as compared with what I knew, and certain others had shrunk; and I suspect that, just as our lecturer told us was the case on Kilimanjaro, the shrinkage has probably been different on the different aspects of the mountain. It appears to me that it is quite likely that in this particular zone a great swing-over of the world's atmospheric circulation may give you for a term of years a different average impingement of moisture-bearing currents on the different aspects of these mountains. We might perhaps learn a good deal as to the general world circulation from careful and prolonged observation on these particular summits. There are no other equal heights to compare with them in position. The Cameroons Peak of West Africa is a much smaller mountain, and so are the mountains of New Guinea. The Andes of South America

intersect the equator, but they form a wall which completely breaks the atmospheric circulation. Therefore they would not give the same results as this pair of isolated heights, 200 miles apart from one another. I hope that it may be possible to set up such observatories.

Mr. C. W. HOBLEY: I should like to express my appreciation of the careful observations which Mr. Gillman has made during his ascent of Kilimanjaro, and his deductions thereon. I personally have been several times on the foothills of Kilimanjaro, but have never had an opportunity of ascending the mountain, for the reason that during the time I was serving in East Africa the mountain belonged to the Germans, and as a Civil Servant I was not supposed to proceed into German territory. I once had the privilege of going pretty high on Mount Kenya, but not so high as Sir Halford Mackinder.

There are two or three points about which I feel rather in the dark. Firstly, I should like to know whether Mr. Gillman is of opinion that Dr. Meyer's theories with regard to the tectonics of the mountain are to be accepted. Dr. Meyer premised that there was an old fracture line of which the Shira ridge was a relic, and that this fracture line ran from west to east through the mountain, being marked by a series of small cones on the saddle to the east of Kibo, and it then impinged upon Mavenzi, of which a sort of buttress remained, and took a turn south-east along the Rombo ridge and past a number of parasitic cones, ending up in the region of lake Chala. It is an interesting theory, and if it is correct one wonders whether the last phase of the eruption of the mountain that is marked by the crater of Kibo, was not after the fracture line had been formed instead of before it. It may be the case that the present crater interrupted this old fault or tectonic line, Mavenzi being of course much older, and according to Dr. Meyer, Shira is also the remains of a crater about the same age as Mavenzi.

Then again, all along the east, north-east, and north sides of Kilimanjaro at the foot of the mountain there is a big area of depression. I should like to know whether Mr. Gillman has any theories about this area of depression. It begins at Jipe lake. Northward of Jipe there is a valley which runs into that lake, and on along the east side of the mountain and on the north and north-east side there is a big chain of brackish and salt lakes; the whole thing extends to a segment of a hundred degrees round the mountain. I have always felt that this great annular depression had some relationship to the eruption of the mountain. There is a similar ring of depression on the north-west of Mount Elgon. We have a series of lakes there which run a third of the way round that volcanic mass.

The next point is a matter of climate. Some time ago, in connection with the military operations, it was my duty to collect a large number of rainfall observations, some of which we had taken, some of which the Germans had taken, and I found that the rainfalls increased very steadily from Kismayu southwards along the East African coast, past Malindi and Mombasa, and on through Vanga down to somewhere about Pangani; and then from Pangani south they gradually decreased again; Dar-es-Salaam had less, Lindi still less. About the mouth of the Pangani river we have a maximum rainfall on the coast, and that compares very well with the principle that the trade wind brings the rain to the coast. The trade winds drift inland and carry moisture from the sea, and the rain-laden clouds hit the south side of the mountain and deposit their moisture. Thus we get more rain on the south side of the big mountains. That fact is observable also on Kenya and on Elgon; the forests and rivers on the south side are greater than on the other

side, on the north side they are trivial. One can almost walk to the summit of Kenya on the north side without meeting thick forest at all. The glaciers on the north are also very small. On Elgon the same features are observed. That proves that the dominant factor which causes the main rains comes from the trade wind, and so far as I know the north-east monsoon has not much effect on the rainfall on most of the mountains. The south-west monsoon, which is the deflected trade wind, blows on the east coast from some time in April to the end of August, and the north-east monsoon does not break until the end of November or the middle of December, and blows to the end of January, but brings, as a rule, comparatively little rain to the coastal zone. Here we have on Kilimanjaro a heavy rainfall on the slopes, and then a dry desert, wind-swept area on the higher levels, and it is somewhat puzzling. On Kenya we have a forest on the slopes and none of that dry desert area on the higher levels. It may be that the wetter area high up on Kenya is due to the effect of the north-east monsoon, but more information is needed.

Why should we get this desert area on the high slopes of Kilimanjaro, which is opposite a place where the rainfall is heavier than anywhere else on the coast? Kenya is far more distant from the sea than Kilimanjaro, which is only, in a straight line, about 150 miles from the sea, and Kenya, taking the route the trade winds have to traverse, must be about 300 miles. The whole matter is full of problems, and I think it would be a great help if we could have some high-level meteorological stations, for I feel sure they would throw a light on the subject.

Note added since the meeting.

It has occurred to me that it is possible that the wet region high up on Kenya above the forest zone may be explained as follows: The continent rises in level as one proceeds inland, and whereas Kilimanjaro rises out of a plain about 2000 feet above sea-level, the country around Kenya has on its south side a level of about 5000 feet. The moisture-laden clouds would, during their journey inland, gradually be forced to a higher level as they pass over the warm plains, and, assuming they are of approximately uniform thickness over this region, precipitation would occur at a higher level on Kenya when they strike the mountain and are cooled down by contact with it. I cannot say if this will satisfy the meteorologists.

Mr. GILLMAN: I should like to say a few words in reply to Mr. Hobley. Before doing so I should very much like to emphasize the desirability of having a scientific station or stations as high up as possible on both the great East African mountains. They will be of the greatest interest not only from the point of view of the meteorologist, but also of the geologist, because both these comparatively recent volcanoes are sure to give us much new knowledge and very promising insight into the building up of volcanoes generally.

That leads me to one of the questions put by Mr. Hobley, that is, whether I agree or not with Dr. Meyer's theory. I am afraid my technical geological knowledge is not sufficiently large to decide this very difficult question, although it would seem to me quite feasible that in a zone which is already very much broken up by earth-movements in the immediate neighbourhood of the great Rift-valley, a vent, such as Meyer supposed it, may exist, and that at various times various centres have been formed on this vent. Thus Shira formed the oldest volcano; the outlet then shifted further east and built up Mavenzi, and for some reason or other when that outlet got choked up it was again shifted further west, and the latest of the three volcanoes, Kibo, was built up between

the two older ones, which in the mean time had already been worked on by wind and weather and ice to a certain degree.

As regards the distribution of the rainfall I have nothing further to say, except that perhaps the absence of a typical desert on Kenya may be due to the topographical form of that mountain. Owing to the two volcanoes, Mavenzi and Kibo, as it were interbedding their lavas a plateau was formed at an altitude where on Kenya no large level surfaces exist.

Sir HALFORD MACKINDER: There is a considerable equivalent to the saddle on the east side.

Mr. GILLMAN: I was under the impression that Kenya was much steeper on every side and had no large flats. In view of Sir Halford Mackinder's statement, the problem remains as dark as ever, and my idea of explaining it by the existence of large flats in one case and their non-existence in the other is out of the question.

The PRESIDENT: It now remains only for me to express to Mr. Gillman, on your behalf, our appreciation of the lecture which he has given to us to-night. The lecture obviously embodies the results of much very careful and painstaking observation, and is one, therefore, which will well repay further perusal when, in due course, it appears in the pages of our *Journal*. Mr. Gillman, it seemed to me, made somewhat light of the physical difficulties of climbing Kilimanjaro, but the fact that of the whole of his party only he and one other, and that one other in a state, apparently, of complete exhaustion, reached the top is significant, and points to the fact that he and his party did have to undergo a very severe physical strain before they accomplished the feat of reaching the summit.

Sir HARRY JOHNSTON, who was unable to be present, sends the following: After a note on the spelling of Chaga, which we have adopted on Sir Harry Johnston's authority in place of the author's Jagga, he proceeds:

The Chaga languages or dialects of one language are one of the most interesting of Bantu groups. They are spoken on the southern flanks of Kilimanjaro from its north-western extremity (Machame) to its eastern ridge (Rombo); also on the adjoining Pare-Gweno Hills towards Usambara, and on the eastern side of Mount Meru. They represent a speech-group of great interest, owing to their affinities in word-roots with the Bantu tongues of Angola and the Cameroons, and the neighbouring forms of West-Central Africa Semi-Bantu speech. They also include a great number of peculiar word-roots without obvious Bantu relationship. According to their traditions the Wa-chaga replaced and absorbed many centuries ago a preceding Pygmy population, of which traces are met with in the Kikuyu country and the northern Rift valley. Though the word *-jagga* seems to have no local right or significance, it is remarkable in its resemblance to the name given in Angola and Congoland to the marauding Va-chokwe, the Giaga or Jagga of the Portuguese records. This tribe lived in the plateau region of easternmost Angola, and in the second half of the sixteenth century boiled over and swept in ravaging hordes over Angola, west-coast Congoland, and most of all Northern Zambezia. From Eastern Zambezia they penetrated Moçambique and coursed up the East African littoral to Mombasa, whence they were finally beaten back by an alliance between the Portuguese and the Esengeju, possibly an immigrant Gala tribe who were in alliance with the Portuguese. But the name "Jagga" did not accompany them beyond the western side of Africa, so it is probably only a mishearing of *Chaga*; and although it is averred that *Chaga* is in reality

unrecognized as a native term, I found it pretty well established on Kilimanjaro in 1884.

Another point to which I should like to draw attention is Mr. Gillman's reference to the absence of any " bamboo belt " on Kilimanjaro above the rain-forest. His remarks entirely concur with my own impression that I never saw and certainly never collected any form of bamboo on Kilimanjaro. This is a fact in striking contrast with what obtains (as he points out) only 80 miles away on the upper flanks of Mount Meru, and on the altitudes of inner East Africa above 8000 feet, and at the same height on Mount Kenya. A bamboo (*Oxytenanthera*) is common in Nyasaland and Northern Zambezia and the uplands of Angola, down as low as 3000 feet. Sporadically *Oxytenanthera* occurs *at low levels* in Equatorial West Africa, always with a suspicion of having been introduced—though this is clearly not true in inner Liberia or Congoland. The mountain bamboos of Equatorial East Africa belong to the genus *Oreobambos*, but their distribution in leaving out Kilimanjaro yet frequenting all other lofty mountains (I think they are found on Ruwenzori and in Abyssinia) is very remarkable, if these points are verified.

A HISTORY OF STEAMBOAT NAVIGATION ON THE UPPER TIGRIS

Captain R. E. Cheeseman, Secretariat of the High Commissioner for 'Iraq

IT is made apparent in Commander Elwell-Sutton's paper " The Tigris above Baghdad," in the *Geographical Journal* for July 1922 (vol. 60, p. 20) and in a subsequent note on the Royal Indian Marine ship *Comet* in the number for August 1922, p. 155, that very little is on record about this vessel or the others that have attempted the difficult passage of the Tigris from Baghdad to Mosul, and nothing about the voyage of the *Baghdad* in 1918, the only steamboat that has ever reached Mosul. Having the opportunity of hearing the story of the *Comet's* adventures first hand from Mr. Tom Dexter, M.B.E., who was engine-driver and acting engineer at the time of her attempt to reach Mosul, I am sending you extracts from his account, and have checked some of his detail with Mr. Rosario, a Goanese clerk, who has been on the staff of the British Residency, Baghdad, for upwards of forty-one years, where Dexter at the present time holds the post of dragoman. I was also fortunate in being able to find Jamil Makhsu, who as engineer in charge of the *Baghdad* gave his own account of her voyage to Mosul and back. All literature and archives accessible out here have also been consulted in compiling and checking the various records, which are not only scattered but confusing.

The first steamer to reach Baghdad of which any definite history can be traced was the *Euphrates* in 1837, Lieut. Lynch in command. She had been assembled and launched on the upper reaches of the Euphrates for a descent of that river on Colonel Chesney's Expedition in March

1836. She had been sold to the East India Company in December 1836 on completion of the work, and steamed up the Tigris to Baghdad. The date for her attempt to reach Mosul, given as 1835 by Commander Elwell-Sutton, should, I think, be 1837.

Colonel Chesney mentions that the *Euphrates* under Lieut. Lynch also proceeded as high up as the bund opposite the ruins of Nimrud, but gives no details. In the 'History of the Indian Navy,' by Lieut. Low, a further note on this journey occurs.

In May 1837 Consul Werry, of Damascus, stated that Colonel Taylor was reported to have ascended the Tigris in the *Euphrates* as far as Mosul, but the next paragraph in the same column places the brand of fiction on the first.

In 1838 Lieut. Lynch in the *Euphrates* succeeded in ascending the Tigris to a higher point than had ever yet been achieved. This was to Kut Abdullah (Sultan Abdullah), near Mosul.

In 1839 the *Nitocris* arrived with two other armed vessels for service in Mesopotamia along with the *Euphrates*. In 1841 the English firm of Lynch & Co. was founded at Baghdad for commercial navigation of the Tigris. In 1843 of the three armed vessels the *Nitocris* alone remained, and Lieut. Felix Jones succeeded Lieut. Lynch in charge of her. In April 1846 Major Rawlinson, the British Political Agent in Turkish Arabia, sent Lieut. Felix Jones on the *Nitocris* to reach Mosul on the spring flood. In his instructions to Lieut. Jones, Major Rawlinson laid stress upon the political importance of ascending the river in order to preserve the right to ascend the Tigris which had been granted by special firman to British war vessels. The *Nitocris* failed in the attempt, as she was only able to go a few miles north of Tikrit owing to the strength of the current (Major Rawlinson's dispatch).

Another account of the same attempt (*Gazetteer of the Persian Gulf*, p. 1401) mentions that the "experiment was a failure, however, owing to the inability of the steamer to make head against the current at the spot where the river passes through a gap in the Hamrin hills not far above Dur (Daur)." The gap in the Hamrin hills would indicate the Fatah gorge, but this is 34 miles in a direct line above Daur. Tikrit lies between the two places. Personally, I should say just north of Tikrit would be correct. Here there are conglomerate hills and cliffs which might easily, in those days when the country was unmapped, have been mistaken for the Jabal Hamrin range.

The same volume mentions that he (Felix Jones) in 1852 made a trigonometrical survey of the country between the Tigris and the Persian hills, from Baghdad as far north as Mosul, embracing the districts of Kifri, Kirkuk, Altun Köpri, Arbil, and Mosul, but in the absence of evidence to the contrary it may be assumed this was done entirely on land.

In 1850 the *Nitocris* was reported unserviceable owing to defective

boilers, and in 1852 the *Comet* (known as the *Old Comet*) was refitted in India and sent to Basra to take her place. She seems to have led a worthy but uneventful existence. Nothing beyond carrying the British mails and maintenance of friendly relations with the tribes, protection of British trade and shipping, and survey and observation work could be traced to her credit.

In 1861 the *City of London*, the first steamer to ply on the waters of Turkish 'Iraq for commercial purposes, was placed on the Tigris by Messrs. Lynch & Co.

In 1884 the new *Comet* was built in Bombay to take the place of the old *Comet*, and was stationed at Baghdad at the disposal of the British Resident. Her gross tonnage was 182, speed 9 knots, drawing 3 feet 6 inches aft, 125 feet long, and 25 feet beam; complement 1 officer, 4 warrant officers, and 35 petty officers and men; armament, two 0·45-inch five-barrel Nordenfelt guns.

Tom Dexter, who will now continue the narrative, was at that time an apprentice seventeen years of age in the R.I.M. Dockyard at Bombay. He was placed on the *Comet* as engine-driver on her trial trip, and as he was a Baghdadi of English and Armenian parentage, he was detailed to accompany her on her journey to Baghdad. At Basra a delay of five days was occasioned by the Turkish Government officials, who wanted to search the vessel, to which objection on the other hand was raised by the British Consul. An understanding seems to have been reached, for she duly arrived in Baghdad.

Her first journey was to Ctesiphon when Mr. Plowden (afterwards Sir Trevor Plowden), then British Resident, went pig-sticking. An early return was necessitated by the sudden death in his bath of the commander, Captain Havelin, whose body was brought to Baghdad and buried.

The inconvenience of having no captain did not deter Mr. Plowden from attempting the projected trip to Mosul. Doubtless he did not wish to miss the spring flood. Twenty days afterwards Mr. Plowden ordered the ship to prepare for the journey. Her bunkers were filled with coal, and the gunner (named Nelson) was placed in charge. A start was made in April 1885, and Fahama, a place 12 miles upstream, was reached, where tents were pitched on the bank. Mr. Plowden used to ride into Baghdad every day. After fifteen days the next stage was begun, and about halfway between Baghdad and Samarra they anchored for the night. Pilots were obtained from passing rafts, in addition to the two on board. Next day they reached Samarra, where they stayed three days. During this time a man named Mahdi Shah, whom they were informed had influence with all the tribes between Samarra and Mosul, was engaged for liaison work at Rs.60 a month. It is probable Mr. Plowden felt some anxiety as to the disposition of the tribes towards such an innovation as a steamboat passing through their territory, and

for the success of the expedition a friendly attitude from those sons of lawlessness was essential.

Tikrit was reached without incident in two days, and one night was spent there at anchor. The next day's progress was very slow, as they were sounding all the way, and when evening fell they anchored. Steaming on again next morning, they felt their way slowly upwards till at noon they ran aground at a place called "Waush-haush." This name is not marked even on the most modern maps, but Mr. Dexter informs me it is on the left bank opposite Khan Kharnina and just below Lug-a-Lug Island, which is 23 miles north of Ṭikrit.

She was drawing 3 feet 3 inches forward and 3 feet 6 inches astern, and having got aground astern in a strong current, swung her bow to the left bank and lay there across the stream. The engines were reversed with no effect. T. Wormsley, the engineer, now said, "I am fed up with Gunner Nelson's captaincy, and I am taking charge." I am assured that these were his very words! Dexter now took the anchor in the cutter, carried it up-stream, and dropped it. They then tried to heave on the anchor, but owing to the pebbly bottom it merely dragged. Meanwhile the ship was rapidly making a bed for herself and sinking in the shingly bottom, and by nightfall her keel was 2 inches lower than the bed of the river. Mr. Plowden now asked if an Arab could be found to go to Mosul to order a raft to float him down to Baghdad. Dexter said, "There is wood on the river-bank, and we can get skins from the tribes near by and thereby save a fortnight's delay."

Wormsley went with a party to cut timber, and Dexter landed on the right bank to find some Arabs. He was in the white uniform of the Indian Marine. He found a crowd of the Jubbur tribe gathered together, and approached them. One man wanted to take his brass-lined helmet, another lovingly fingered his brass buttons. In conciliatory language Tom asked to see the Shaikh, and he was taken to him. After the usual salutations and the Shaikh's curiosity having been appeased, they got to business.

Tom asked that 200 men with spades might be supplied in the morning to try and force the ship off her present position, promising R.1 each; he also asked to be allowed to purchase forty skins ready for inflating for the raft, the price to be 12 annas each in addition to a bag of sugar and a bag of coffee for the Shaikh. A bargain was concluded on these terms, and they parted agreeing never to forget each other.

It was soon evident that a friendly understanding had already been established, at least on the right bank of the river, for towards evening the Shaikh himself came on board bringing the skins, and was paid. With the idea of impressing him he was shown round the ship, and many awe-inspiring powers were ascribed to the various parts without much regard to veracity. To take an instance, the funnel was described in whispers as an engine the effects of which were too awful to mention,

but it was only used in extreme cases of dire necessity. The crew worked on the raft all night by shifts, and on the top a hut was built.

By daybreak all was ready. At 9 a.m. Mr. Plowden started to float down the river to Baghdad. Bidding farewell to Wormsley, his last words were: "If you can't get out, stick it and do your best." Again I queried this ultra-modern phraseology, but am assured they were the exact words used in 1885!

The prospect before the stranded ship and her crew was none too bright. They all knew she must remain for a year at least unless she could be floated off before the flood subsided. The scanty protection that could be expected from the Turkish Government in such a predicament made it imperative that a most careful handling of their predatory neighbours the Arabs should be maintained.

Next morning at daybreak, as arranged, a large crowd of Arabs was seen approaching from the tents of the friendly Shaikh. Some of them were taken across in the cutter, the rest swam to the ship. The river was sinking every minute. At that moment Mahdi Shah, the "liaison officer," appeared on deck and called out, "Come and help. O my brothers, come and help." On seeing him the Arabs without further ado swam back across the river and were gone. Tom Dexter in consternation turned to the Shaikh, who was still with him, and asked the reason. He replied that eighteen years ago this man was a Turkish Government official on this stretch of the river, and had a bad reputation with all the tribes. "He is well known, and no one will have anything to do with him, and they would kill him if he was not on your ship." Wormsley did not like to send Mahdi Shah away without authority, as Mr. Plowden had brought him on board, and for several days no Arab would come near, and the crew were unable to purchase milk or chickens.

The next event was the arrival of mails and provisions by caravan, which brought news that the new commander, Captain Percy Downs, was on his way up to join the *Comet*. He arrived by another caravan fifteen days later, and by this time his ship was high and dry. His first action was to send Mahdi Shah down-river, and Tom Dexter was placed in charge of all dealings with the tribes. He built a small hut on the river-bank, where hospitality to all comers was dispensed in the shape of hot coffee and tobacco. Friendly relations were now re-established. Several scares occurred to relieve the monotony of the long wait. The Hamawand tribe from the north came on their periodical raid into the territory of the Obaid tribe near by, and intercepting a mail caravan robbed it of 3000 golden liras and killed a Christian. A party of Turkish cavalry were sent out to punish the marauders, and approached the river to look at the *Comet*. They were first espied in the distance by the Arab pilot while in the midst of his prayers. Without finishing he leapt to his feet with a yell and raised the alarm. "The Hamawand are upon us!" A great consternation prevailed for some twenty minutes, and

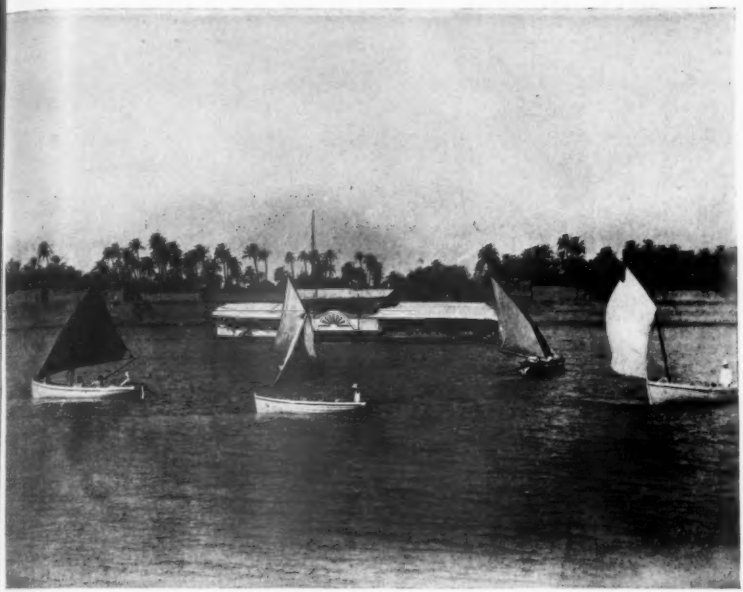
the decks were cleared for action, until the red fezzes of the cavalry proclaimed their nationality.

That night the Turkish officers dined on board, and such was the hospitality that they had to be helped on to their horses when they left with fervent expressions of goodwill. The Turkish Government eventually sent two Turkish soldiers to guard the ship, and moreover made the Shaikh of the Obaid tribe responsible for the safety of the crew. Dexter also mended the pots and pans of the local tribes with so much success that a petition was lodged by the blacksmiths and coppersmiths of Tikrit with the Wali of Baghdad, asking him to restrain the amateur tinker. On representation being made to Mr. Plowden he refused to take any action, explaining that it was necessary to keep the tribes amiable, and he saw no obligation on his part to order the work to cease. On one occasion, seeing a band of mounted Arabs in the distance, Dexter thought a visit on a bicycle might impress them. Mounting his 54-inch bicycle he went out to meet them dressed in his white uniform. The effect was not exactly that desired. The whole cavalcade turned and put their horses into a gallop, and nothing could be seen of the column but flying dust and gravel. Doubtless the unfamiliar outline had been sufficient, and the mirage had done the rest.

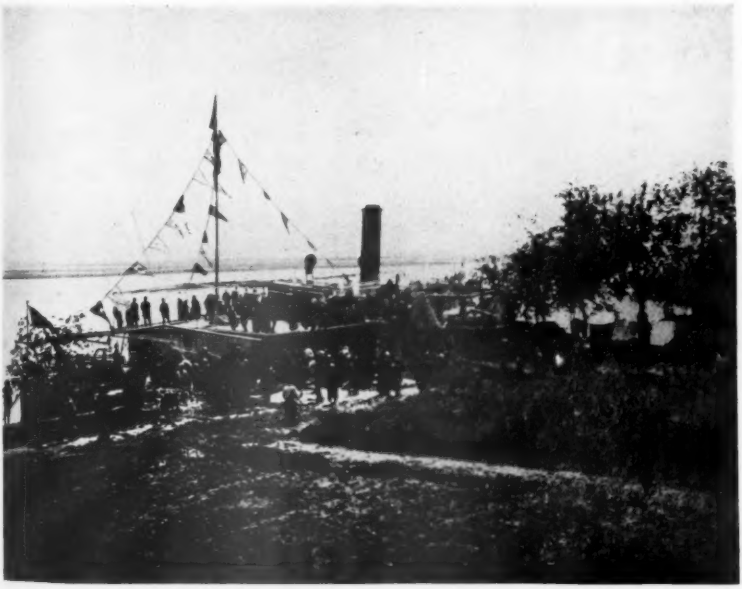
Subsequently a rumour reached the ship that a long thin white Jinn haunted the lands of Waush-haush, that was three times as high as a man and could travel faster than a horse. The bicycle afterwards became famous, and visitors from distant tribes came in from afar to see for themselves this wonder of machinery. Another expedient of Tom Dexter nearly ended in tragedy. By dispensing simple medicines he achieved local fame as a doctor. While attending the wife of the Shaikh, the beautiful daughter fell in love with him. She used to come and gather wood on the river-bank and sing, " Tom, my beloved, all the ships pass by, but the steamer of Tom is anchored here. She is aground, and by God's wish he is going to be my husband.' I am assured that in Arabic this makes beautiful poetry. This romance eventually reached Captain Downs, who, becoming alarmed, forbade Dexter to leave the ship until he explained that he was the victim of circumstances.

In April the river and their hopes rose, and on the top of a big flood the vessel once more moved into mid-stream with steam up. Amid much shouting on both banks from their friends the Arabs, the *Comet* turned and steamed downstream. She reached Baghdad without mishap in twenty-four hours, after an enforced residence of over eleven months. In 1894 the *Comet* again reached Samarra, as mentioned by Commander Elwell-Sutton.

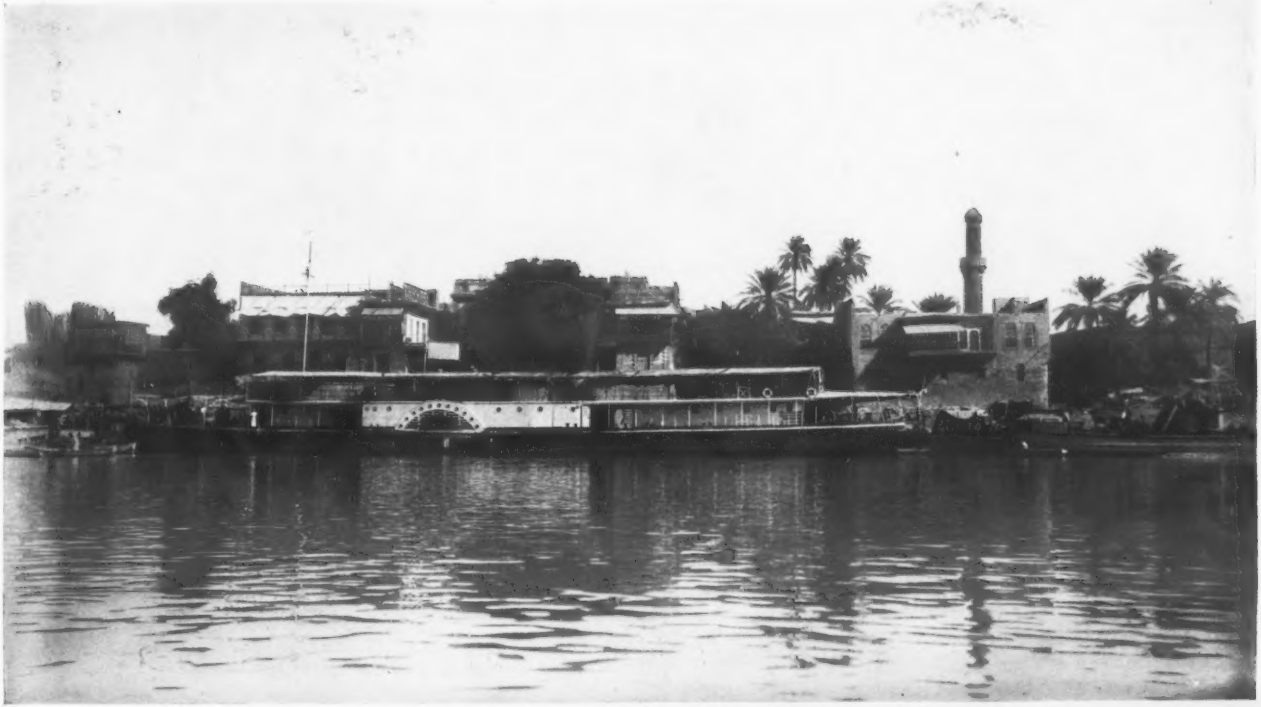
The *Comet* next came into prominence in 1914. On the eve of the declaration of war with Turkey, she in company with the *Mejidieh*, a boat belonging to the Lynch Company, conveyed some 300 British



THE NEW "COMET," R.I.M., WITH CREW AT BOAT DRILL OPPOSITE THE OLD BRITISH RESIDENCY, BAGHDAD, 1900



THE S.S. "BAGHDAD" AT MOSUL, APRIL 1918



THE S.S. "BAGHDAD" AT BAGHDAD, 1922

refugees from Baghdad to Muhammerah in Persian and neutral territory. The presence of the *Comet* in Muhammerah was objected to by the Turks, and they demanded that she should leave neutral waters, thereby running the gauntlet of all the Turkish batteries, lined along the Turkish bank of the Shatt al 'Arab, at point-blank range. Sir Percy Cox, then Chief Political Officer to the Expeditionary Force, gave orders that the Bahmanshir Channel—a shallow cut connecting Muhammerah with the sea, parallel with the Shatt al 'Arab and well concealed by date palms—should be sounded, and water was reported sufficient for her passage. One day, unsuspected by the Turks, the *Comet* steamed through this backwater and joined the Mesopotamian Expeditionary Force viâ the Persian Gulf. The Turkish commander was then informed that his demand had been complied with.

The *Comet's* life was doomed from now to be a short and merry one. She ascended the Shatt al 'Arab with the victorious British Army and followed the varying fortunes of that force on the Tigris. She was in action from Qurna to 'Amara, and it was on board the *Comet* that General Townshend reached 'Amara and received the Turkish commander's surrender on 3 June 1915. She was again in action in the advance on and during the first battle of Kut al 'Amara, 26 September 1915, when Lieut.-Commander Cookson, R.N., who was on board, was killed in a gallant enterprise for which his name was honoured with a posthumous V.C. The end came below 'Aziziya in the retreat from Ctesiphon on 1 December 1915. The gunboat *Firefly* had grounded on a mud bank with a shell through her boiler. The *Comet* went to her assistance, but was hulled several times by shells, being set on fire and rendered unmanageable. Both were abandoned by Captain Nunn, the Senior Naval Officer. The *Comet* was left aground and in flames. The enemy's artillery was firing heavily on both sides, but the crews managed to get away in their small boats.

The *Baghdad*, a German-built vessel belonging to the Hamidiya Steamship Navigation Co., a Turkish company of Baghdad, was requisitioned during the recent war by the Turkish army for river transport of stores on the Tigris. Her length was 212 feet, beam 60 feet, draught 4 feet 9 inches loaded, tonnage 500.

At the fall of Baghdad, March 1917, she was lying at Kadhimain, with Captain Shallal in charge, and Jamil Makhsu, who narrates this, was engineer. They then ascended the river with short delays at Sindiya, Samarra, and Tikrit. An enforced wait was occasioned at Tikrit, as the coal ran short and they had to remain till coal from Kifri was brought down in mahailas, when they got upstream and reached Sharqat. From Sharqat she was taken to Qaiyara, where another shortage of coal caused delay. The coal from Kifri was no longer obtainable, owing to the British occupation of that neighbourhood, and they had to wait for coals to be floated down from Mosul on rafts. With the help of this and some

THE S.S. "BAGHDAD" AT BAGHDAD, 1933

wood and oil steam was raised, and in the month of April 1918—that is, on the top of the biggest flood of the year—they reached Hamman Ali, and six days after the *Baghdad* was tied up on the left bank below the bridge in the middle of Mosul town.

Jamil Makhsu remained on the *Baghdad* after the British occupation of Mosul, and a guard of twenty-five Sikhs was placed in charge. Everything movable had been taken away by the Turks, but no damage had been done to her boiler and engines. Major Starkey, of the Inland Water Transport, visited her to arrange her descent of the river. About March the following year an engineer from Inland Water Transport arrived to take charge of the navigation. Jamil pointed out there was not enough water, but a start was decided on. All went well until they ran hard aground about an hour above Tikrit. Here she remained for yet another year, reaching Baghdad on the following spring flood. She is now owned by Abdul Khader Pasha el Khedery, an Arab shipowner, and is plying between Basra and Baghdad.

The *Khalifa*, a smaller but similar steamboat belonging to Messrs. Lynch Brothers, which had been seized at Baghdad by the Turks, accompanied the *Baghdad* as far as Qaiyara, where on account of shortage of fuel she was abandoned and was subsequently used as an officers' mess for a British military post at Qaiyara after the capture of Mosul in November 1918.

The writer stayed one night on board her on 7 December 1918. Her machinery and boiler being undamaged, the staff of the I.W.T. eventually brought her down to Baghdad. She has now been returned to her original owners, and plies between Baghdad and Basra with passengers and cargo.

Another famous boat, the *Julna*, may be mentioned as having ventured on the waters of the Upper Tigris. Her heroic attempt to run the blockade to carry food to the famished garrison at Kut, when Captain Cowley, who was in command, was killed and all his crew either killed or taken prisoners, is a matter of history. To him also a posthumous V.C. was awarded. The *Julna* was refloated and used by the Turks, who re-christened her the *Kendi Gelan*, which is the Turkish for "She came herself into our hands." They eventually in their retreat took her just above Tikrit, when she ran aground and was blown up to save recapture.

NORTH KORDOFAN TO SOUTH DONGOLA

Major H. C. Maydon

THE object of this trip was to find and shoot Addax, Leucoryx and sheep; but as it led me through new country, it may be of some outside interest. To any one who has made inquiries the name of

Addax must be coupled with long stretches of waterless desert in the Dongola Province, with Bir Natrun the only known wells in a sea of sand.

As I was stationed at El Obeid, on the recommendation of General Jackson, Governor of Dongola, I decided to strike up from the south-east. Thanks to the kindness of the Governor of Kordofan I was able to meet a sheikh of the Kabbabish Arabs, Nimr Hassan, and discuss ways and means.

He had led a patrol of Arabs in 1916 during the occupation of Darfur against the Geraan tribe in North Kordofan and South Dongola, and knew the country. As he assured me that we should find game, I left the route to him.

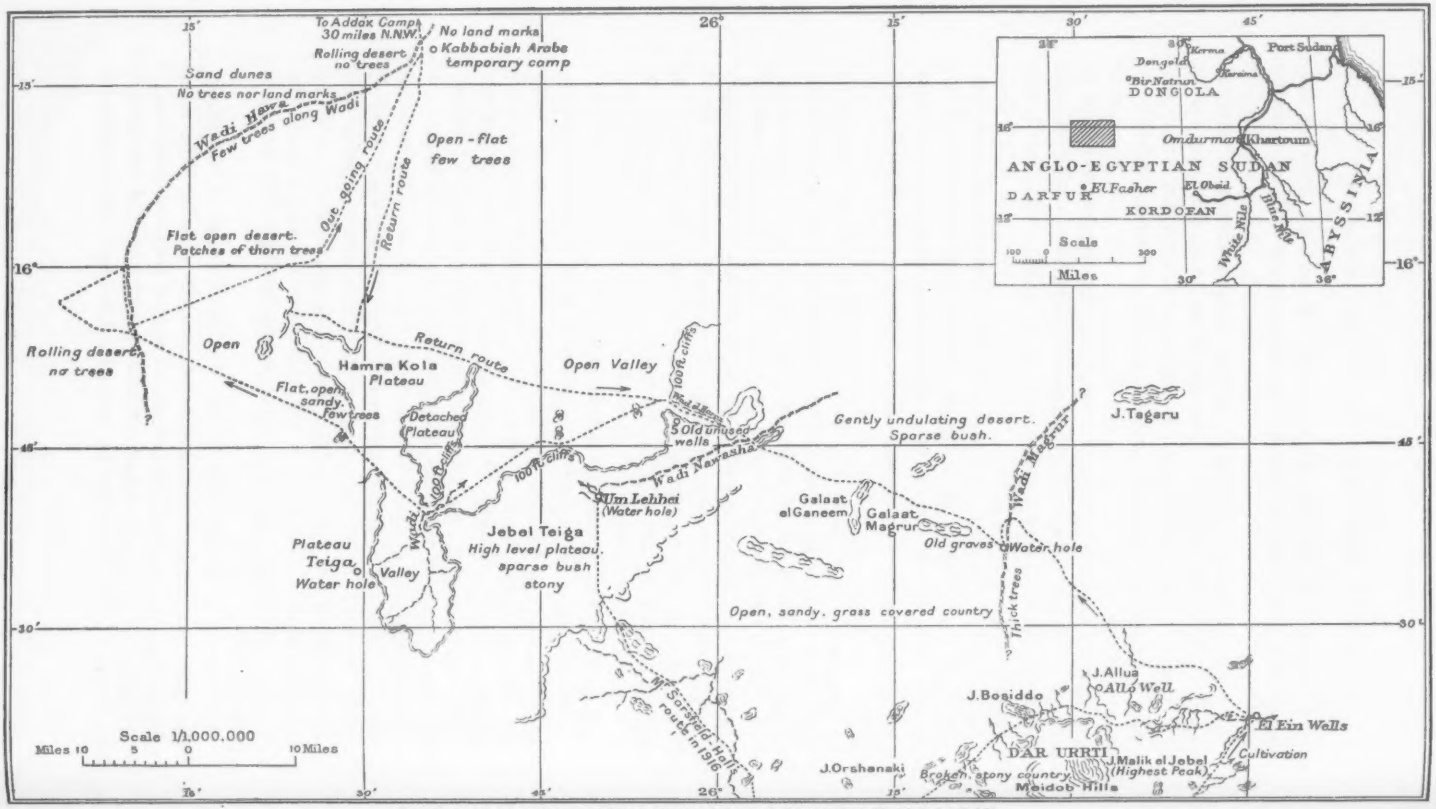
At the end of January 1922 I met Sheikh Nimr Hassan at Soderi, the furthest headquarters of a British official in Northern Kordofan. Nimr had collected my caravan of twenty camels, which included eight for ten-gallon water-fantasses, and six for mounted scouts as guides and hunters.

Three days' march across undulating scrubby country (waterless) brought us to the ferik of Nazr Ali Thom, of the Kabbabish Arabs, where we found plentiful water in wells and much hospitality. Ali Thom is an exceedingly intelligent and clever Arab chief, and is one of the selected few who made a short visit to Europe in 1919. He is a short, dapper little man, with piercing eyes, a sharp turn of humour, and a habit of asking questions which take a deal of answering. The wonders of invention aroused in him a polite interest. Much more marvellous to him was our copious water and green fields, and how we divided our land to make room for so large a population.

After one day's halt we continued the march to Jebel Meidob, 90 miles north-west. It is rather flat country, broken by small isolated stony jebels and occasional broad wooded wadis. The usual thorn trees are common, and there is much Heskinit grass. On nearing Meidob the country breaks up into long sandstone ridges and flat-topped plateaux, rather like the country along the Nile between Shellal and Halfa.

Meidob is a large group of hills about 60 miles in circumference, and probably not more than 600 feet above the surrounding plain, but visible for quite 30 miles. It is a very disappointing place, almost treeless, with scanty patches of dry grass; neither grand nor inspiring, and with no prominent features. There are a few wells at odd intervals round the base, where live several distinct clans of Nubas (blacks) under their own separate chiefs.

We camped at El Ein wells in the north-east corner of the jebels. Water here was obtained in the usual fashion by digging deep holes in the sandy bed of a wadi, just where it emerged from the rocky spurs of the hills. Depth about 12 feet. Water seemed plentiful, but though there was a Nubawi ferik close by, arrangements were quite inadequate



Sketch-map to illustrate Major Maydon's route from Jebel Meidob to Addax.

for their supply. Jebel Meidob has been partially explored before by Mr. Sarsfield Hall and Mr. Boyce, and I am told that water on the western side is contained in an extinct volcano.

After resting one day to fill our water-fantasses and to water camels, we struck out north-west into an unexplored country without inhabitants. Nimr gave out that we were now making for the northern end of Jebel Teiga, shown on the map by a hazy line put in by Mr. Sarsfield Hall, mainly from hearsay, though he had been as far as Um Lehhei in 1916 by another route. Although there was no track of any sort and very few landmarks, the Arab guides never hesitated but led straight north-west, which I checked by compass. After clearing the rocky foothills we entered a large undulating plain. It was fairly easy going over the usual hard sand, in thin bush and Heskinit grass country. Jebel Tagaru was plainly visible due north of Meidob and about 30 miles distant. Broad sandy wadis with thick shady trees were frequent and formed ideal midday camps. Dorcas and red-fronted gazelle were common, and Addra gazelle were plentiful in large herds. But all small game such as guinea-fowl, partridge, rock pheasant, hares, and bustard were very rare. Nimr stated that four years ago we should have seen oryx near by, but nowadays they only came down in the rains.

At about 20 miles from Meidob we reached the Wadi Magrur, running from Meidob towards Tagaru. Here we halted a day and explored for old water-holes in the bed. Nimr was very anxious to establish a water base here in case of drawing blank at the rather mythical water-holes (geltas) in Teiga.

Magrur wadi is one of the biggest we passed, about half a mile broad and full of thick trees and dense reeds and bush. Probably stagnant water remains here long after the rains. We found some very ancient water-holes, quite neglected, and after strenuous work digging, got very dirty water in small quantities. It would pull us through at a pinch, but was not hopeful.

Near by the water-holes, but far up the bank of the valley, I found several very ancient burial-grounds, where several hundred persons must have been buried. They were marked by small piles of stones, and in some cases the oblong shape of the grave was marked by selected bits of white stone stuck upright, and once or twice by a huge rough sort of headstone. There was no trace left of any buildings. A few queer stone beads were found. As the Nubas always stick to their hills, and the few Arabs hereabouts were all nomadic, it is hard to account for so large a graveyard. The present water supply would not sustain a large village permanently.

Three Meidobis passed us here from Bir Natrun. They were very thirsty and tired. They reported all quiet at Bir Natrun. "All people there like brothers," and no sign of the turbulent Geraan.

Three more marches brought us to Wadi Nawasha, broken country

and more foothills. These were the spurs of Jebel Teiga, and the big wadi itself they say leads towards Um Lehhei water-hole. From here a two hours' uphill march, rather stony and bad going for camels, and we dropped suddenly into the fine gorge called Wad el Haraz. This was one of the prettiest spots I have seen in the Sudan: a 200-yards-broad sandy wadi, shaded by immense green trees, and shut in by abrupt sandstone and rocky cliffs about 100 feet high. Further on the Wadi bed widened into an open valley, and side nullahs ran down into it.

If you climbed the cliffs you found yourself on a flat plateau stretching for miles and miles, always ending in a 100-feet sheer drop to the level of the open plain, save where broken by gorges and wadis. There was very little vegetation and very few trees on the plateau.

In Wad el Haraz we found fresh tracks of Barbary sheep (Mai), desert lion and leopard, while Addra and gazelle were common. On the return journey I camped and hunted here. My camels out grazing one night were attacked by a lion, easily driven off. I saw sheep, but they were very rare.

While hunting we found five ancient wells, drilled in the rock on top of the plateau, but close to the wadi. From all appearances they could not have been used for scores of years, nor did any one know of them. They were choked up with sand at 10-feet depth, but by scratching we found damp sand below, and my Arabs swore there was good water further down, but we had neither time nor implements. There were many fragments of ancient burmas (clay pots) scattered about. Water is so vital in this part, with the nearest certain at Meidob, 60 miles away, that it seems strange these wells should have been forgotten. They were found only on the return journey, so it was essential to discover if there was water at Um Lehhei and Teiga before pushing on.

Scouts were sent to Um Lehhei, while the main caravan went on north-west to Teiga gelta, which lay nearer our direction. Water was found at both places, in rocky pools, sweet and good. This was the last water we should find. The next nearest was at Bir Natrun, 300 miles north.

After filling fantasses and watering at Teiga we continued north-west, leaving the hilly plateau and crossing another belt of desert. This was gently undulating and fairly hard going, with plenty of Heskinit grass and occasional clumps of thorn trees. So far we had always had good shade and plenty of firewood.

One day out from Teiga we passed (lying east of us) the spurs of another large flat plateau, Hamra Kola, with the same abrupt cliffs. Next day we reached Wadi Hawa. This is a notable landmark, and the natural boundary between the ordinary Kordofan desert and the true desolate desert of Dongola. Its course is marked and visible from at least 10 miles, by the line of trees growing in its bed. It is reputed to run from north-western Darfur towards Dongola town, passing immediately

south of Bir Natrun. The dry sandy wadi bed was full of camel tracks coming and going. Nimr told me that the wadi is now used as the best route from Darfur to Dongola or Bir Natrun in place of the old Arbain road.

North of Wadi Hawa all forms of trees and shrubs cease, and all firewood must be carried. There were three sorts of short, coarse, mossy grass growing in patches, which fortunately the camels liked. There were no landmarks. The desert became sharply undulating, a succession of switchback dunes. The going, though too heavy for walking in comfort, suited the camels. It was rather light-coloured heavy sand, firm enough to keep a perfect impression of tracks.

We explored 20 miles north of Wadi Hawa in this part. Leucoryx, Addra, and gazelle were fairly common, but no sign of Addax except for many old skulls and bones, generally confined to very narrow areas, where they had apparently followed the last of the grazing.

We struck back across the Wadi Hawa and 50 miles east shot several good oryx *en route*. Our scouts at last met Kabbabish Arabs grazing their herds along the Wadi Hawa, and got reliable news of Addax. It appeared that owing to the exceptionally heavy rainfall in Dongola the previous year there was very good grazing in these parts, and some of the Kabbabish Arabs had come across from north Kordofan, 200 to 300 miles. Their animals—camels, sheep, and goats—were living entirely on the grazing and were never watered. The men and women drank nothing but milk from their animals. Their advent had driven most of the game north.

Collecting a guide from them who had seen Addax, we re-crossed the Wadi Hawa and pushed north about 60 miles. Ostriches, which had been rather rare before, were now very common, sometimes in herds of fifty to a hundred. Nests of eggs were everywhere, generally ten to twenty eggs, but once about sixty together, probably three nests, side by side. The wandering Arabs look on ostrich eggs as fair spoil, and live on them to a great extent.

We at last found Addax tracks and made our final camp, with enough water to give us three days' hunting, being then roughly 200 miles north of the nearest water at Teiga, and by report 120 miles south-west of Bir Natrun. The method of hunting was to leave camp at dawn on camel-back with two scouts and your lunch, and ride in large sweeping chukkers, returning at night. Owing to the switchback country, spotting was difficult, and the close stalk was tricky, as you generally found the quarry at the bottom of one sandy dell and you in another, with a convex dune between.

Addax were not common. I saw only five bulls in the three days. Leucoryx were plentiful, sometimes in herds of fifty or sixty, and fairly easy to stalk. Addra and red-fronted gazelle were absent. There were plenty of Dorcas, and also what appears to be a new variety of

Dorcas, smaller and always single or in pairs at most. The Arabs had a distinct name for it, but I had no time to shoot one. There was a queer sort of desert cat with long ears, which lived in holes.

Although there were no recent traces of man—and how should there be in that waterless desert?—yet I was surprised at the number of fragments of broken burmas we found in certain areas. Sometimes a dozen or so would be found unbroken all together. They were very old, and a different sort of clay from the common had been used in their manufacture. The Arab nomad carries a water-skin when on safaria, seldom a burma.

There is a myth that once there was water in the Wadi Hawa, and that part of that country was fertile. But perhaps fugitives from northern Darfur in the Mahdi's time had fled north-west across the desert, carrying what water they could in burmas.

At the end of three days and fairly good sport we returned direct to Wad el Haraz, sending camels ahead to collect water and meet us there. Thence we came back practically by the outgoing route, save for a détour south-east of Meidob to shoot sheep at Abu Buzma. That was queer country too, with broken hilly ground full of deep cracks and fissures. Here we found water again, in a deep underground cave. This was known to and used by passing Arabs, but it was a hidden treasure they were loath to speak of. Here also were ancient burial-places, this time marked by huge piles of stones and all record of them lost. The Arabs in those parts cannot be persuaded to take an interest in what is dead and finished.

Perhaps my most remarkable memory of the trip was my Arabs' unfailing sense of direction. There are true and ugly tales of whole expeditions being lost in the desert Bir Natrun way, yet to my men it seemed so absurdly simple. Let me give an example. It was the Addax camp in the completely featureless desert of rolling dunes. Three Arabs and I left camp at dawn. After an hour we dropped one Arab. Camp was to move later on our tracks and be pitched again where we left the third Arab. We were out all day hunting, moving in circles, ending up roughly 14 miles from the new camp. At sunset we started back, and were delayed by a stalk after Addax just on dark. When we restarted it was to all intents and purposes pitch dark. Tracks were invisible. There was no moon. Yet those Arabs never hesitated. To my perturbed questions they replied, "Oh, over there," and pointed. After riding two or three hours we saw a tiny point of light in the far distance. "Good," said the guide; "they have lit a grass fire. Otherwise we might have missed the camp by 100 yards or so." It took nearly two hours to reach camp then, which gives some idea of the uniform level of the sea of sand-dunes.

I have one further experience to add in this regard. One day I wandered off half an hour from camp with a camel boy. On turning for camp there was not a sign. This time the tent was pitched under a clump

of trees. Tent and trees had disappeared. In reply to my question the boy pointed in mild surprise. There was nothing. A blank rolling desert. After walking half an hour and still seeing nothing, I grew anxious. Then we crossed a dune, and there 40 yards away stood trees and tent. It was in a slight depression, visible for miles from one angle, invisible at 50 yards from another. But the desert Arab possesses another sense more precious than sight, and cannot get lost.

From Jebel Meidob north and west I had nothing but a blank map to go by. By compass bearings, calculating length of marches, and observation, I did my best to fill it in, but the result can be only very rough. The names of prominent features, such as hills and wadis, were all supplied by Nimr Hassan, but those which could be checked were all correct.

The climate between January and March was perfect, with a strong cold north wind.

A COMBINED THEODOLITE AND PRISMATIC ASTROLABE

E. A. Reeves

THERE seems to be no longer any doubt that equal altitudes can be more accurately observed with Claude and Driencourt's *Astrolabe a Prisme* than with an ordinary theodolite, and now that Dr. Ball and Mr. Knox-Shaw have simplified the whole system of observation and computation by their book 'The Prismatic Astrolabe' and its useful tables, there is good reason to suppose that it will become more generally adopted as time goes on, at any rate in countries where a clear sky at night can be depended upon.

One drawback to its more general use so far has been the fact that the prismatic astrolabe is a special instrument which can be used for no other purpose than measuring the angle of altitude of 60°, and a surveyor has to take with him a theodolite as well for his triangulation, traversing, and any other astronomical observations. On large and important expeditions when carriers are numerous and there are few transport difficulties, an additional instrument perhaps makes little difference, but on small exploring expeditions, with only a few men rapidly pushing on through difficult country, every pound in weight is a serious matter, and since a theodolite must be taken in any case, the prismatic astrolabe is likely to be left behind.

To meet this difficulty, it occurred to me some time ago that it might be possible to combine the two instruments by fitting a simple attachment, on the astrolabe principle, to the theodolite. This attachment, which Messrs. Casella & Co. have made for me, is shown in the figure, fitted to an ordinary 6-inch micrometer theodolite. It consists of a simple ring, about 1 inch deep, carrying a prism with angles of

60°, and an arm beneath which carries a shallow circular tray, or dish, containing a thin copper plate covered by a mercury film forming the reflecting disc as in the prismatic astrolabe. This tray is made of wood, and a lid covers the reflecting disc when it is not in use. The tray and reflecting disc can be detached from the arm, which is hinged so as to fold back out of the way when necessary. The whole attachment—ring, prism, and mercurial reflector—forms one piece, which slides on to the object-glass end of the theodolite telescope. When not required it can be taken off and placed in a receptacle in the theodolite case. It only weighs a few ounces, and can readily be fitted to any theodolite, provided the telescope is of sufficient size and power for observing small stars, such as are frequently used in this equal-altitudes method.

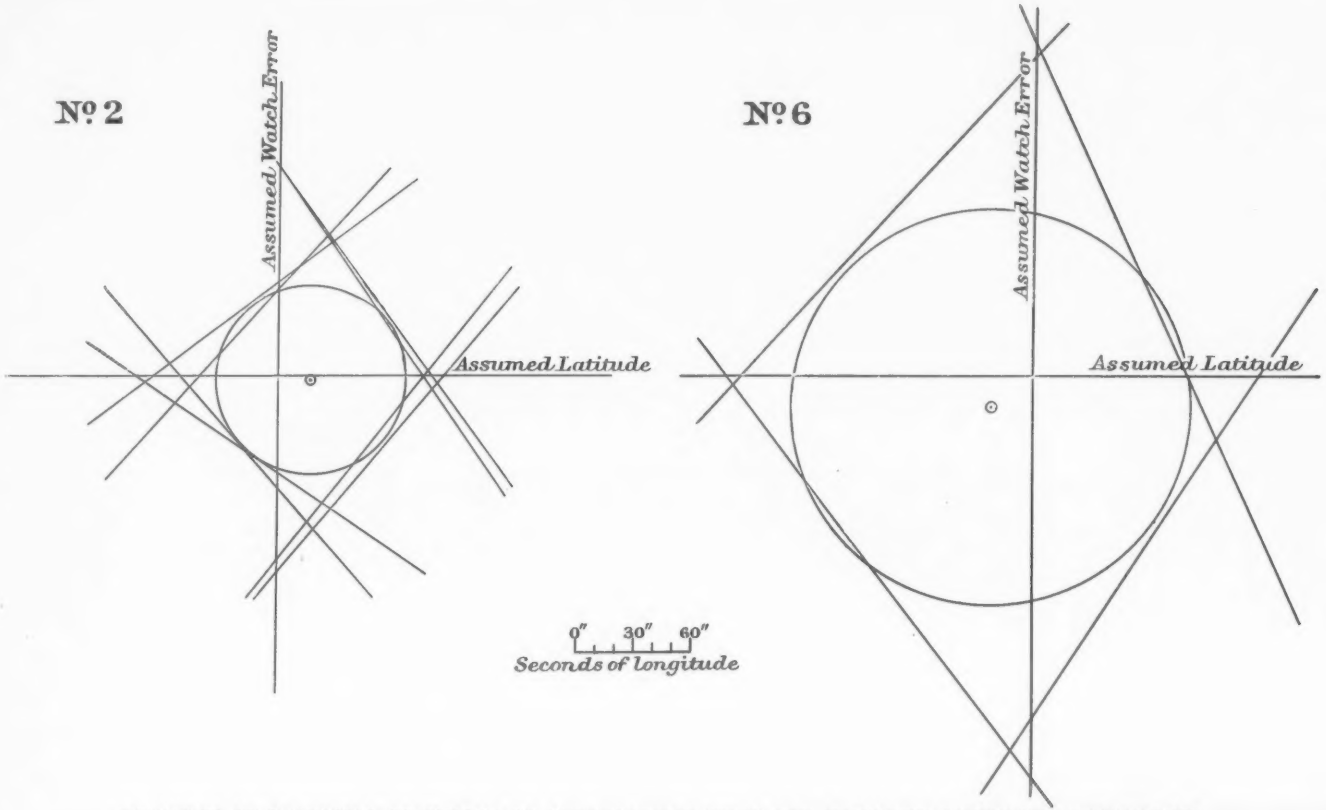
The attachment I have had fitted to a theodolite has been most satisfactorily used recently by three of my pupils in the Society's course of instruction in surveying—Lieut. O. M. Miller, M.C., Mr. Weld Arnold, former Austin Teaching Fellow in Astronomy at Harvard University, and Mr. J. J. Tindal, late Capt. Gordon Highlanders—and the following are some of the results they have obtained. The observations were taken, computed, and plotted as described in Ball and Knox-Shaw's book on the Prismatic Astrolabe.

RESULTS OF OBSERVATIONS FOR LATITUDE AND LONGITUDE TAKEN WITH A PRISMATIC ASTROLABE ATTACHMENT FITTED TO A 6-INCH THEODOLITE, AND WIRELESS RECEIVING APPARATUS (EIFFEL TOWER SIGNALS).

Place.	Error of watch.		Observed longitude in time.	Observed north latitude.
	On G.M.T. by wireless.	On L.M.T. by astrolabe.		
	secs.	secs.	secs.	° ′ ″
1. Crawley ...	46·2 slow	0·8 fast	47·0 west (·7)	51 6 45 (49)
2. ,, ...	38·4 ,,	9·2 ,,	47·6 ,, (·7)	51 6 49 (49)
3. Earlswood Common	53·7 ,,	13·5 slow	40·2 ,, (·2)	51 13 44 (43)
4. ,, ,,	20·4 fast	59·5 fast	39·1 ,, (·2)	51 13 46 (45)
5. Greenwich Park (south of)	17·8 ,,	17·7 ,,	0·1 east (·0)	51 28 20 (18)
6. ,, ,,	0·0	1·4 slow	1·4 ,, (·4)	51 28 19 (16)
7. Betchworth Clump	47·5 slow	18·3 fast	65·8 west (·4)	51 15 05 (05)
8. Ditchling Beacon	0·4 ,,	25·1 ,,	25·5 ,, (·5)	50 54 04 (03)

The figures in brackets are from the 6-inch Ordnance Survey, with which it is interesting to compare the results of the Astrolabe observations, although it should be borne in mind that the former are geodetic positions, based on triangulation, while the latter are astronomical, and liable to be affected by deviations of gravity. The general character of

SIX-INCH MICROMETER THEODOLITE WITH PRISMATIC ASTROLABE ATTACHMENT



EXAMPLES OF GRAPHICAL SOLUTIONS OF OBSERVATIONS WITH THE PRISMATIC ASTROLABE ATTACHMENT

the observations is shown by the plotted figures of two of the results (Nos. 2 and 6). No. 6 was plotted before the error of the prism angle was known, and No. 2 after a correction to the altitude had been made for this error.

Before commencing the observations it is necessary to ascertain that the astrolabe attachment is in correct adjustment, and this can be conveniently done without any special collimating arrangement, provided the exact value of the angle of the prism is known, which can be supplied by the maker. It is, of course, nominally 60°, and in a good prism is not likely to differ more than a few seconds from this value. The operations are as follows:

(1) Level the theodolite and adjust it carefully in the ordinary manner both as regards horizontal and vertical collimation. Select some well-defined distant point and place it accurately on the central intersection of the cross hairs.

(2) Fix the astrolabe attachment to the theodolite and depress the telescope to an angle below the selected fixed point exactly equal to the angle of the prism. The selected point should now be on the central intersection of the cross hairs of the theodolite, but if this is not the case, it must be brought into this position, both horizontally and vertically, by turning the two screws for the purpose which will be found (at right angles to one another) near the base of the prism in front of the object glass.

(3) Now raise and lower the telescope by means of the vertical tangent screw, and see if the selected point remains exactly on the central vertical hair; if it does not, turn the whole attachment slightly round by the clip screws that fix it to the telescope till this is the case. To ensure accuracy it is well to repeat these operations, but the attachment should now be in sufficiently good adjustment to commence the equal altitude observations.

All that remains now is to set the altitude circle to 0°, place the mercurial reflector in position, see that the level is correct, and commence the observations.

When the observations are being made, if it is found that the two images of a star will not pass vertically through one another, they can be made to do so by a final touch of the adjusting screws.

If the angle of the prism is not accurately known it can be found as follows: Before the attachment is fitted to the telescope, measure the exact altitude of a selected distant fixed point, taking "face left" and "face right" vertical angles, and correcting for level error; then fix on the attachment, without the mercurial reflector, place the level bubble in the centre of its run by the clip screws and lower the telescope till the distant point is on the central intersection of the cross hairs, and note the reading of the vertical circle. Reverse the instrument, and repeat this operation "face right." The mean of these "face left" and

"face right" readings, plus the altitude of the selected point previously found, will be the angle of the prism. Set this angle on the circle and bring the point on to the central intersection of the cross hairs by the adjusting screws of the prism. It is advisable to go over this operation a second time to be sure that it has been correctly carried out.

No very great accuracy is required in these adjustments, and provided there is only an error of a few seconds, the final results of the observations are not likely to be seriously affected, since, by the system of observation of the stars in different quadrants, constant errors tend to balance one another.

THE TOPOGRAPHY OF CAESAR'S CAMPAIGN AGAINST THE BELLOVACI (51 B.C.)

Dr. T. Rice Holmes

THE view which I advocated in *Caesar's Conquest of Gaul** that the Bellovaci encamped on Mont St. Marc, about 5 miles east of Compiègne, and Caesar on Mont St. Pierre, just south of their position, has lately been controverted by Dr. H. O. Forbes.† I omit to notice those of his arguments which apply equally to any sites that have been or could be proposed, and are therefore self-destructive.

Ancient writers rarely satisfy modern topographical requirements; and the description given by Hirtius,‡ our sole original authority, is not sufficiently definite. The essential part, so far as Dr. Forbes and I are jointly concerned, amounts to this. The Bellovaci and their allies encamped on a hill, standing in a wooded country and protected by a morass. This morass was at the bottom of a deep and narrow valley, separating the hill from another on which Caesar pitched his camp; and the position of the Gauls was so strong that it would have been impossible to storm it without very heavy loss. Frequent skirmishes took place in the valley, 'a few men charging from both sides' (*paucis utrimque procurrentibus*). The hill upon which the Bellovaci were encamped was separated by another small valley (*mediocris vallis*) from a hill (*iugum*), the summit of which formed a plateau, and the sides of which were steep; and this hill was large enough to admit of four legions being drawn up on it in line of battle. Caesar reached it by bridging the morass; and the bridge or causeway was constructed within a single day. About 10 Roman (rather more than 9 English) miles from the camp of the Bellovaci was a very strong place, upon which they encamped after they had been compelled to abandon their original position. Somewhere in the neighbourhood of this second encampment was a meadow not more than a Roman square mile in extent, which was

* 2nd ed., pp. 826–30.

† *Geogr. Journ.*, **59**, 1922, pp. 195–206. ‡ *De Bello Gallico*, viii, 6–20.

surrounded partly by woods, partly by a very deep river. This meadow was said to be not more than 8 miles from the second camp of the Bellovaci.

Dr. Forbes objects that the sites which I, in agreement with de Saulcy, Stoffel, General Creuly, and Camille Jullian, have indicated are in the territory of the Suessiones, whereas he in common with those authorities infers from the narrative of Hirtius that the Bellovaci encamped in their own country; that St. Marc 'is not, nor could be, *surrounded* by a marsh,' whereas Hirtius describes the Bellovacan stronghold as *locum . . . circumdata palude*,* and that 'To-day, whatever may have been the case in 52 B.C.' [or rather 51], it is not 'protected by any wet land of consequence'; that St. Marc cannot be considered "hard to ascend"' (*tanto collis ascensu*),† for he has himself 'walked up leisurely' from Rethondes 'across the supposed site of the Belgic camp to its south-easterly edge and back to the village in 45 minutes'; that the valley between St. Pierre and St. Marc is not 'deeper than wide' (*magis in altitudinem depressa quam late patente*); ‡ that 'Hirtius's text . . . nowhere authorizes the assumption that Caesar's camp was placed on a hill at all'; that Caesar's 'ramparts . . . would be superfluous . . . on St. Pierre, whose slopes rendered it protected as sufficiently as, or better than, St. Marc'; that the plateau of St. Pierre, 'only some 700 yards by 500 in extent seems . . . inadequate to accommodate the Roman army, numbering . . . probably some 30,000 men'; that 'the expression *procurrentibus*' § 'suggests a very different situation from that of camps perched on steep eminences 2 miles apart'; that no 'spot in full view of the two presumed camps' can 'be recognized answering to' the *vada transitusque paludis* ‖ (fords and crossing-places of the marsh) which Hirtius mentions; that the depression between St. Marc and Mont Collet—the ridge (*iugum*) ¶ on which Caesar must have formed his second camp if the first was on St. Pierre—is 'only 10 metres below their level' and cannot be described as a valley (*mediocri valle*); ** finally, that 'the extreme edge' of the ridge, on which Caesar planted artillery, is 'more than 2 miles from the centre of St. Marc's plateau . . . while the range of the Roman *tormenta* rarely exceeded 1,200 feet.' Dr. Forbes argues, further, that Mont Ganelon, on the right bank of the Oise, could not have been the stronghold to which the Bellovaci retreated, because Caesar could have prevented them from reaching the Oise, which, moreover, was unfordable; that the meadow on the left bank of the Aisne in which *ex hypothesi* they attacked Caesar's cavalry †† was so close to St. Marc and St. Pierre that it would have been rifled by the foragers long before; that Hirtius's account ‡‡ of the messages which Caesar sent to his troops during the action and before he arrived on the scene shows that the meadow was much more than 3,000 yards from his camp; and that, if it had been so near, Hirtius could not have

* *B. G.*, viii, 7, 4. † *Ib.*, 14, 3. ‡ *Ib.*, 9, 2. § *Ib.*, 10, 2. ‖ *Ib.*, 13, 1.
¶ *Ib.*, 14, 4. ** *Ib.* †† *Ib.*, 18, 1; 20, 1. ‡‡ *Ib.*, 19, 4.

said that Caesar 'discovered (*videbat* *)' 'the river flowing between the field and the "very strong place,"' for 'it must have been hourly in evidence during his occupation of Mt. St. Pierre.'

Now the extreme limits within which the operations must have taken place are known; and if Dr. Forbes will examine sheets 32 and 33 of the *Carte de l'État-Major* or, like de Saulcy, explore the terrain, he will admit that, if St. Marc and St. Pierre do not satisfactorily answer Hirtius's narrative, no other sites answer as well.

It is not certain that St. Marc and St. Pierre were in the territory of the Suessiones: Camille Jullian † argues that they were in that of the Bellovaci. But if, as Dr. Forbes evidently believes, the eastern frontier of the Bellovaci was the Oise, and if, as he insists, their camp and that of Caesar were within their territory, the strong place to which they afterwards retreated must have been east of the Oise; for it was separated from Caesar's camp, and therefore also from the camp which they had abandoned, by a deep river,‡ and there was no other. Thus Dr. Forbes must admit that on his theory they fled from their own country into that of their enemies! *Circumdata*, as every Latin scholar knows, does not necessarily mean 'surrounded.' Caesar, for instance, describing the battle in which he defeated Ariovistus, says that the Germans 'closed their whole line with wagons and carts, to do away with all hope of escape' (*omnem aciem suam raedis et carris circumdederunt, ne qua spes in fuga relinqueretur* §), the wagons and carts self-evidently, and as the context proves, closing only the rear and flanks of the line, not the front, where the battle was about to be fought; and Hirtius may only have meant that the hill on which the Bellovaci encamped was fringed by a marsh on the sides on which it was exposed to attack. The Ru de Berne, which flows between St. Marc and St. Pierre, may well have overflowed its banks in consequence of the recent heavy rains; ‖ the ground which Hirtius, perhaps loosely, calls a marsh, was constantly crossed by both the Belgae and the Romans; and the Ru de Berne in that part of its course over which Caesar was obliged *ex hypothesi* to make causeways widens out into *étangs*. The short time which Dr. Forbes took to ascend St. Marc is irrelevant: if he had been one of Caesar's legionaries, he would have known that to ascend even a gentle slope in the face of an enemy was a perilous enterprise.¶ No valley that I know, except in one place the gorge of the Cheddar Cliffs, is 'deeper than wide'; the words by which Hirtius, if my view is right, describes the valley between St. Marc and St. Pierre evidently mean that its depth—some 60 metres, or about 200 feet—was more impressive than its breadth—less than half a mile across the floor; and, as Camille Jullian ** wrote

* *B. G.*, viii, 20, 1.
† *Hist. de la Gaule*, iii, 1909, p. 547, n. 8.
‡ *B. G.*, viii, 18, 1; 20, 1.
§ Cf. *B. G.*, i, 51, 2.
‖ *Ib.*, viii, 5, 4.
¶ Cf. *Anc. Britain*, p. 629 and n. 7.
** *Op. cit.*, p. 547, n. 2.

after he had seen it, ' L'expression *valle intermissa, magis in altitudinem depressa quam late patente* . . . me paraît désigner la vallée entre Saint-Marc et Saint-Pierre, vue surtout du nord de cette dernière colline.' Caesar generally encamped on rising ground; and since a deep valley intervened between his position and the hill occupied by the Bellovaci, it is self-evident that he too occupied a hill. Ramparts on St. Pierre would not have been ' superfluous,' because Caesar wished both to impress the enemy with the belief that he was afraid of them and to render his position, when he could only spare a few men to hold it, impregnable.* Does Dr. Forbes fancy that the wall of Gergovia,† on the summit of a mountain, was superfluous? The area of the plateau of St. Pierre was about 62 acres; Caesar's camp at Gergovia, which was occupied by 6 legions, whereas in the Bellovacan campaign he had only 4, covered only 87 acres; and a camp described by Hyginus, considerably less than 100 in extent, accommodated 40,000 men.‡ The ' steep eminences ' were one, not two miles apart; the valley that separated their bases was, I repeat, less than half a mile wide; and if Dr. Forbes will consult Meusel's *Lexicon Caesarianum*, he will not find the slightest difficulty in ' the expression *procurrentibus*.' The *vada transitusque paludis* may have been paths, like those that now cross the Ru de Berne. Scrutinize the *Carte* or Napoleon's plan (Planche 29), which is on a much larger scale and exactly agrees with it, and you will see that what Camille Jullian § calls ' le ravin nord entre le mont Collet et le mont Saint-Marc ' might be called a *mediocris vallis* as reasonably as the depression on the southern side of the mountain of Gergovia which Caesar ‖ calls ' a considerable valley ' (*satis magna valles*): you will also see, within range not of ' the centre of St. Marc's plateau ' (which is irrelevant), but of the probable position of the Belgic front, the place where Caesar would have posted his artillery. The assertion that the Aisne and the Oise were ' unfordable ' is pointless: for the retreating Bellovaci crossed a river, which must have been one or the other; and unless the Oise was fordable or, like other Gallic rivers,¶ spanned by bridges, how did the Bellovaci intend to invade the country of the Suessiones? The Bellovacan baggage-train got away by night,** and the fact that Caesar did not attempt to cut off the retreat of the combatants need present no difficulty when one reflects that, encamped on St. Marc, they would have been much nearer then he both to the Aisne and the Oise, that they could have interposed in strength either in the narrow passage between the forest and the Aisne or in that between the Aisne and St. Marc, and that, being obliged to leave part of his army to defend

* *B. G.*, viii, 10, 1.

† *Ib.*, vii, 47, 3. 7.

‡ *Caesar's Conquest of Gaul*², p. 664.

§ *Op. cit.*, p. 550, n. 2.

‖ *B. G.*, vii, 47, 2.

¶ *Ib.*, i, 6, 3; ii, 5, 6; vii, 11, 6; 34, 3; 58, 5–6; viii, 27, 2. The Oise near Compiègne may be unfordable *now*; but it has been canalized. Cf. *Caesar's Conquest of Gaul*², p. 675.

** *B. G.*, viii, 14, 1.

his camp, he may not have been strong enough to risk the attempt. No soldier would see anything improbable in Hirtius's statement that Caesar sent gallopers to let the commander of his cavalry know that he was coming to the rescue even if the scene of the combat was only 7,000—not 3,000 * yards away; and Dr. Forbes, for whose translation of *videbat*, 'discovered' (which Hirtius would have expressed by *compererat* or *cognoverat*) I would substitute 'saw,' forgets that Caesar saw (*videret* †) that his camp was separated from that of the Bellovaci by a marsh, which must also have been 'hourly in evidence,' after he had been many days on the scene. The combat may not have taken place in a meadow by the confluence of the Aisne with the Oise, and the strong place may not have been Mont Ganelon; but I adhere to the view that Mont St. Marc and Mont St. Pierre are the most probable sites of any that have been or, in default of archaeological evidence, can be named. To quote de Saulcy, 'J'ai souvent parcouru, et dans tous les sens, ces magnifiques forêts [Cuise, Compiègne, and Laigne], et je n'y ai reconnu qu'un seul point qui concorde avec la description d'Hirtius; mais il est vrai qu'il présente une ressemblance si saisissante avec le terrain sur lequel tous les faits de cette campagne se sont déroulés, qu'il faudrait être plus que difficile pour ne pas y reconnaître le lieu cherché.'

* Measured on the *Carte de l'État-Major*, the distance *in a straight line* to the meadow opposite Choisy-au-Bac, where Napoleon placed the combat, is nearly 9,000 yards; to the spot midway between Choisy and Rethondes, where General Creuly placed it, more than 6,500. Dr. Forbes may reasonably insist that, as I freely admitted in *Caesar's Conquest of Gaul*, both these sites are less than 8 Roman miles from Mont Ganelon; but when he says that the meadow in question 'was 8 miles from the strong place,' he does not accurately report the statement of Hirtius (20, 1), according to whom the camp on the 'strong place' 'was said to be not further than 8 miles, more or less, from the battle-field' (*quae non longius ab ea caede abesse plus minus VIII milibus dicebantur*).

† *B. G.*, viii, 14, 4.

THE MOUNT EVEREST KINEMATOGRAPH FILM

EVER since the invention of the moving picture one has heard talk of the immense educational value that the film might have if it were properly used. But looking back one is bound to confess that few pictures have come up to the standard of intelligence and sincerity that are essential if they are to be truly educational. There was the wonderful picture in colours years ago of the Delhi Durbar. The moving record of the second expedition of Captain Scott made a well-deserved success, and also introduced us to the humours of the penguin; and in many ways most striking of all was the picture that Sir Ernest Shackleton showed two years ago, when the *Endurance* was crushed before one's eyes. All three were accompanied by lectures, and the last in particular owed very much of its success to the personality of the lecturer.

Other films there have been for which educational value was claimed: travel pictures that were made at great trouble and risk and expense, often admirable in their photographic technique, and portraying scenes of the greatest interest. Yet in one way or another many have failed to reach that precise standard of variety and excitement with serious interest that seizes the imagination and brings the public to be entertained while they are being educated. Therein lies the great difficulty, that to produce a good film is tremendously expensive, and there is the ever-present temptation to heighten the incident, to stage effects, to compete with the product of the studio, and thereby to increase its value as a public entertainment, but ruin it as a sincere record of events.

When the Mount Everest Committee were organizing the first expedition of 1921 they were faced with the alternatives, of making no kinematograph record of the expedition, or of employing a professional operator; and they preferred the former, believing that it would be better to wait than to run the risk of having a picture produced that might be rather out of tune with the spirit in which the expedition was conducted. And it was easier to take this decision because it was hoped that Captain Noel would be able to join the expedition of 1922. His skill as a photographer had been shown in his journey to Tashirak and in a later reconnaissance of the Caspian provinces of Persia. While on the staff of the School of Musketry at Hythe he had produced many instructional films for the work of the school; and his enthusiasm was proved when he resigned his appointment there rather than miss the great opportunity afforded by the Mount Everest Expedition.

General Bruce, in his reports to the Committee, and in his lecture to the Joint Meeting on October 16, bore witness to the endurance, the skill, and the resource which Captain Noel showed throughout the expedition of 1922, and the first-fruits of his work were exhibited at the second Joint Meeting at the Central Hall on November 21. But the conditions at that meeting were unfavourable to a correct appreciation of his results. The great size of the hall, filled with London fog: the difficulties of projection in an operating room still in the hands of the builders, and the absence of the music which is now so striking a part of the show, combined to minimize the finer effect of what now proves to be, in its presentation at the Philharmonic Hall, a singularly impressive spectacle.

The first part illustrates the journey from the plains of India through the dense tropical forests of the Himalayan foothills towards the Jelep Pass, with its sudden transition from the wealth of vegetation and insect life to the high bare and dry highlands above the tree line; then the long marches over the wind-swept plains of Tibet, the camps thronged with ever-curious Tibetans, the industries of the people, the official visits of the Dzongpens, the arrival at the Rongbuk monastery, and the ceremonial reception of General Bruce by the Chief Lama, who lent

strong spiritual aid to the expedition by his blessing of the porter-corps. Captain Noel describes this first part.

Then in an interlude without lecture, but with music, we have a wonderful picture of the lama ceremonies and the "Devil-dancing" that takes place every spring in the monasteries: a picture which appeals even more to the anthropologist and the student of drama than to the geographer. By great good fortune the party included a man who combined in one person the climber, the painter, and the musician, not to mention that his real business in life is to be one of the foremost of the younger surgeons. Mr. T. Howard Somervell recorded the airs which the Nepalese porters sang and the wandering minstrels played on their fiddles: the music of the monastery clarinets, and the rhythm of their drums and magnificent long trumpets. He has arranged this music for an English orchestra of unusual composition, and the show gains thereby a distinction which should compel a second visit from those who saw only the first presentation at the Central Hall.

The third section, described by Mr. Somervell, shows the mountaineering from the start of the reconnaissance party for the East Rongbuk glacier to the reluctant withdrawal after the disaster that befell the third attempt. In a series of beautiful scenes one follows the climbers and the porters in their passage of the seracs, the life at Camp III., the climb to the North Col, and the several attempts on the mountain. Captain Noel had bad luck at the start in that his photographic porters were commandeered for the general transport when the local levies deserted, but by forced marches he reached Camp III. in time to make a most striking picture of the evening descent of the first party to the North Col, and of their return to camp next morning. He then carried his outfit to the North Col camp and photographed the second ascent from 23,000 feet until they were lost to sight against the dark rocks at somewhere over 25,000 feet. His studies of rushing cloud and wind-swept snow are magnificent, and he must be congratulated most warmly upon the result of a remarkable effort of endurance and skill. All who have tried it agree that the mental and nervous faculties are much diminished at these excessive heights. By strict concentration it is possible to do one thing, but it wants a very good man to attend to the many details required of a kinematographer operating with an enormous telephoto lens in camp for four days and nights at 23,000 feet, with the added responsibility of commanding the supports for the high-climbing party above him. Captain Noel is diffident of his results, and it has needed some persuasion to induce him to show some parts of the picture of the highest interest, but somewhat marked by the electric discharge in the camera that it seems almost impossible to avoid altogether in these conditions. We believe, however, that all who see the pictures will agree in thinking them most worthy of his reputation as a photographer, and worthy also of the fine climbing effort which it was his privilege to record.

The Mount Everest Committee, faced with the necessity of organizing a third expedition to complete their enterprise, have to rely in great measure on the proceeds of this kinematograph record for the requisite funds, and after careful consideration have decided that the film should be shown to the public for a season under their auspices at the Philharmonic Hall, in the best conditions possible for doing justice to the interest of the subject and the high accomplishment of the climbers. They hope that every Fellow of the Society will assist them by bringing the show to the notice of their friends. Now, if ever, is the opportunity for the moving picture to prove that it can be thrilling and entertaining, and at the same time educational in the best sense. If these pictures do not appeal to the public at large, it will be because they are resolutely averse to being entertained by real life, however strange and exciting. That remains to be seen; but we are confident that the kinematograph record of the Mount Everest Expedition of 1922 will attract and please many who have a well-founded mistrust of the instrument in its common use. A long career is being mapped out for the film in the principal cities of Great Britain, and later throughout the world. All friends of the Expedition will wish it success everywhere on its travels, with plentiful results for the further prosecution of the enterprise to which this Society and the Alpine Club are jointly committed.

REVIEWS

EUROPE

The Place-names of Lancashire.— Eilert Ekwall, Ph.D., Professor of English in the University of Lund. Publications of the University of Manchester, English Series, No. xi. Published by Longmans, Green & Co. 1922. *Price 25s.*

The Place-names of Middlesex.— J. E. B. Gover, B.A. (Cantab.). London: Longmans, Green & Co. 1922. *Price 5s. net.*

THESE are both good books of their kind, but Dr. Ekwall's marks an epoch in the study of English place-names. It bears the hall-mark of true scholarship, and one feels that the author has spared no pains to ensure accuracy. Dr. Ekwall has definitely set the pace for students of British place-names; his book will be a standard of reference for all future workers.

Certain criticisms, however, may be offered. On page 18, in discussing O.E. **tang*, **twang*, the author says of Tangmere, in Sussex: "The original situation of Tangmere is doubtful. The place was named from a lake which has now disappeared." This is not necessarily so. The suffix *-mere* is frequently used in O.E. to describe artificial ponds in places where a natural lake is a geographical impossibility; many of these ponds are still in existence, *e.g.* Rockmoor Pond, at the point where Hants, Berks, and Wilts meet. We find also *Thorc mere*, in Birch, *Cartularium Saxonicum*, iii. 1080; *meres byrig*, B.C.S. ii. 787, referring to the prehistoric hilltop camp on Ladle Hill, Burghclere, Hants; *risc maere*, B.C.S. ii. 625, now Rushmoor Pond (Hants, 34 N.E.).

Port (p. 257) is not necessarily connected *archæologically* with Roman sites,

whatever its philological pedigree may be; it was the word used in O.E. for town; Port Meadow outside Oxford, Portway and Port Field (*passim*) are instances, and others are given in N.E.D. We are glad to find that the author (p. 257) connects "Eccles" in place-names with the presence of British churches there. We have long maintained the same derivation for Echinswell, Hants, the ancient site of whose church was at the source of the "ecclesburna" (B.C.S. ii. 674). "Coc rode," which is generally explained as having the same signification as "cockshoot" (p. 261), occurs in O.E. pre-Conquest land boundaries, thus proving, if proof were needed, the great antiquity of the practice. We wish that Section iv. of the Summary had been fuller, and that the historical conclusions had been illustrated by maps showing the distribution in Lancashire of the different elements in the place-names. Without them these conclusions are unintelligible, and, for practical historical purposes, useless. Readers cannot be expected to make their own maps from the author's facts. For general reference purposes the reader may be reasonably expected to provide himself with a 1-inch Ordnance map; but this will not show him the area of the Hundreds, which form the author's basis of classification. A key map of the Hundreds should have been given. A map of ancient river-names would have been easy to compile and interesting to study—a line block in the text would have been enough. These omissions mar an otherwise excellent book.

It is for Mr. Gover an unfortunate accident that his little book on Middlesex place-names has appeared at the same moment as Dr. Ekwall's, with which it will inevitably be compared. Such comparisons must necessarily be unfavourable to Mr. Gover. We should much prefer to be able to compare his book with others on place-names written by Englishmen, and to say that it is better than many of them. As it is, we can only regard it as a good piece of amateur work. The author does not indulge in the wild speculations which made so many older works ridiculous. The derivation of Gospel Oak, Hampstead (p. 31), from a place "where an open-air preacher held forth in former times during Rogation week" seems unlikely. It is far more probable that it was a bound-mark where "a cross was cut and a Gospel read, and cakes and ale given to all those present" during some perambulation. We dislike the explanation of "healh, heale" (p. 35) as meaning "a nook, corner, retreat." It is too suggestive of summer-houses and semi-detached villas. The Saxons, who like all primitive people had a wonderful "eye for country," had words for every kind of natural topographical feature, and "healh" was one of them. Probably it meant, as Dr. Grundy suggests, a "hollow" distinct from a valley. The early forms of the lost manor of Rugmere, St. Pancras, quoted on p. 73 (1086, Rugemere; 1291, Rugmē) suggest an O.E. form *rugan mere*, "rough pond," rather than "*hrycg mere*," which would have produced "Ridgemere." The suggested derivation of Staines (p. 79) from a stone used as a boundary-mark, "perhaps the point where the Colne flows into the Thames," is very weak. Why should not so excellent a natural bound-mark as the point of confluence of two rivers be enough without a stone? Moreover, settlements come first with their names, and are not named after points fixed later on their boundaries. It is usual to connect Staines with the Roman settlement Pontes; and it is in this quarter that the origin of the name should be sought. The selection of "caps and smalls" for the catch-headings is unfortunate, since the words do not catch the eye as they should; heavy type would have been better. The alphabetical arrangement, however, is a great convenience. The book is written on scientific lines and it gives *facts* and references; we are

therefore able to check the author's own derivations for ourselves, and that, after all, is the main thing. Further advance in the study of English place-names will hardly be possible (even for professional students) until we have a *corpus*—a New English Dictionary of Place-Names, such as Professor Mawer's Survey promises to give us. O. G. S. C.

East Carelia and Kola Lapmark.— Edited by **Theodor Homen.** London: Longmans, Green & Co. 1921. Pp. xiv. + 264. *Illustrations and Maps.* 21*s.*

Originally published in Finnish in 1918 and later in Swedish, this book aims to give an exhaustive account of one of the least-known regions of Arctic Europe. Various chapters by different authorities deal with the physical features, fauna, flora, races, history, economic life, and social conditions of these two districts. Economic and social conditions are described as they were before the revolution of 1917. Among the authors of the geographical sections may be mentioned Dr. J. G. Granö, Mr. Th. Brenner, Mr. P. Eskola, Mr. O. Lönnroth, and the editor. The book had its origin in the movement of the Carelia to separate from Russia and join with Finland, but it is not propagandist and these ambitions are not stressed. The Carelians, who comprise about 50 per cent. of the population of Russian Carelia, are a branch of the Finns, who have been subjected for centuries to Russifying influences. Their country is poor and unproductive and their economic status low. The only prosperous areas are the small timber ports on the White Sea, and there Russian interests are strong. It cannot be said that the irredentist movement in Carelia dates from long ago, nor that its strength is within the country. Undoubtedly it has been fostered if not born in Finland, but it certainly exists at present and forms a real problem in northern Europe. The real arguments against the cession of Carelia to Finland is afforded by the Murman railway, which would thus be cut, and the arrival of a Baltic state on the White Sea. In the case of Kola Lapmark the problem is less acute, because Carelians are not in the majority. The area approximately corresponds with the Russian province of Alexandrovsk, in which there are many Finns and Carelians—in fact, a majority—on the Murman coast and around Kola fjord, but very few in the Kola peninsula. Since this book was written Finnish aspirations to the Murman coast, with its ice-free port, have been met by the Treaty of Dapot, signed with the Russian Soviet in October 1920, by which the Pechenga territory is ceded to Finland. The volume contains a number of useful coloured maps and some sixty photographic views. It is a valuable contribution to the geography of northern Europe. R. N. R. B.

The Czecho-Slovak Republic: A Survey of its History and Geography, its Political and Cultural Organization, and its Economic Resources.— Jaroslav Cizar and F. Pokorný. London: T. Fisher Unwin; Prague: Orbis Publ. Co. 1922. Pp. 218. *Maps and Illustrations. Price* 9*s. net.*

It is natural perhaps that writers of books and pamphlets on the Czecho-Slovak Republic should show an almost inordinate desire to place their country in the most favourable light possible. It is a matter for regret, however, that this desire should sometimes be gratified at the expense of historical accuracy and occasionally of actual fact. In the historical chapter of this book we are told that Bohemia became a kingdom in 1038 instead of 1156; the title given to Wladislas II. in 1086 being for his life only. No mention is made of the treaty made by Charles IV. by which, in case of failure of the respective dynasties, the countries of Austria, Bohemia, and Hungary were to be united.

This agreement in the words of Count Lutzow "may be considered as the origin of the Austro-Hungarian Empire" as it existed until 1918. The Hussites are said to be the same as the Bohemian Brethren persecuted by Ferdinand II., the same sect of Bohemian Brethren, the Hussite Protestants, having been first persecuted by the Hussite King George of Poděbrad who imprisoned and put to the rack Brother Gregory the famous follower of Chelčicky. General Žeižka is called the "inventor of modern strategy." Žižka did wonders with his few thousand followers and invented the mode of fighting with waggons used by the South African Boers, as Wallace invented "squares," but "modern strategy" hardly.

The separation of Bohemia and Slovakia for nine hundred years is not made quite clear, and the chapter on the identity of the two peoples is not convincing. At the present time a party in Slovakia is asking for autonomy, while in Sub-Carpathian Russia the Ruthenes have not yet received their Autonomous Diet or Representation in the House of Deputies promised them.

The chapter on geography shows that the area of the country is 54,877 square miles, of which Bohemia, Moravia, Silesia claim over three-fifths, Slovakia 19,000 roughly, and Carpathian Russia 5,000. The climate is said to form a mean between the maritime and continental climate, but not many Czechs will agree with the statement that Bohemia has a winter lasting $2\frac{1}{2}$ months only!

The book is otherwise well arranged, and forms a complete compendium of information on the country concerned. There are chapters on literature, music, science, religion, and on Fine Arts, while the Economic Survey embraces statistics of all the industries carried on. With regard to the latter it is well to observe that the year taken, 1920, is probably the most successful year experienced by the Republic, and that for the last few months the country has been suffering from a very acute crisis in the export trade. This is due to many causes, chiefly the financial *débâcles* in Austria and Germany, but also to the rise in the value of the Czecho-slovak crown.

There is a list of watering-places which includes many places unknown hitherto to English ears. The illustrations are numerous and admirable both in themselves and their subjects.

There is a list of commercial treaties and a chapter on the customs policy of the Republic, as to which latter further inquiry is recommended. The licence system at present shows no sign of disappearing. F. J. C.

ASIA

Among the Head-Hunters of Formosa.— Janet B. Montgomery McGovern, B.L., with a Preface by **Dr. R. R. Marett.** London: T. Fisher Unwin, Ltd. 1922. *Price* 15*s.*

Mrs. McGovern has given us a very interesting and sympathetic account of the hitherto practically unknown head-hunters of the interior of Formosa; thus the book helps to fill up a gap in ethnological literature. The brief account which is given of the history of Formosa forms a useful preliminary. The low fertile land of the western half and northern portion of the island is inhabited by "Formosans," who constitute the vast majority of the population; they are of Chinese descent. Since 1895 the Japanese have been masters of the island, and all official positions and the wealth of the island are not unnaturally in their hands; they number about 125,000, whereas there are about 3,000,000 Formosans. From an ethnological point of view the aboriginal inhabitants (not more than 105,000 in number) are the most interesting; they are steadily

diminishing, and are being driven constantly further up into the mountains, the Japanese but continuing what the Chinese began. Mrs. McGovern has something to say about the treatment of the natives by the Japanese, and, reading between the lines, this is borne out by the official 'Report on the Control of the Aborigines in Formosa,' published by the Bureau of Aboriginal Affairs, Taihoku, Formosa, 1911. The map given by Mrs. McGovern is indirectly taken from this Report. Her investigations were made mainly among the Taiyal group of peoples, who occupy the northern half of the mountain area, but she adds suggestive information about most of the other groups, which shows that various cultural influences have been at work, doubtless due to several migrations. Head-hunting, as is often the case, determines the social and political standing of the men; it is a preliminary to marriage, and is regulated by a rigid code. Among the Taiyal, a man or boy who has a head to his credit is tattooed on the chin; on arriving at maturity a boy should go on his first head-hunting expedition, which is usually done in company with several other boys of about the same age. There is no record of cannibalism, past or present. Generally throughout the mountain area chieftainship descends from mother to daughter, but it is elective among the Taiyal. Among the southern and eastern groups obtains the custom of bachelors' houses on piles and a system of age-grades. The Ami of the east coast are more democratic in religion as well as in politics than the mountain tribes; that is, the theocracy of the priestesses seems less strong. New fire is made at the time of the sowing and harvest festivals, and this is accomplished among the Bunun by a man using a fire drill, but among the Taiyal the sacred fire is made by a priestess by the "saw" method. This sample must suffice to demonstrate the value of the book. There are twenty-six excellent photographs. The numerous (undescribed) plates in the Report above referred to illustrate many of the statements made by Mrs. McGovern. A. C. H.

AFRICA

A History of the Arabs of the Sudan, and some account of the people who preceded them and of the tribes inhabiting Darfur.— H. A. MacMichael, D.S.O. 2 vols. Cambridge: University Press. 1922. 90*s. net.*

The full title of this most difficult book to review gives a fairly definite idea of the distribution in time and space of the peoples with whom Mr. MacMichael deals; it does not however even hint the plan upon which the work is written. The treatise consists of four parts or sections occupying two volumes, the second and stouter consisting of the translation of some thirty native manuscripts, while the greater part of the first volume consists of a series of essays or disquisitions, based both upon the information contained in these manuscripts and upon the author's own observations of the peoples among whom he has lived.

The first volume begins with what is rather a shadowy account of the inhabitants of the lower Nile Valley—in its widest sense—before the advent of Islam. These chapters are succeeded by an account covering some fifty pages of the non-Arab races of Darfur forming a really valuable introduction to the ethnography of the country. Here is gathered together all that is known of the Bedayāt, the Ḳura'an, the Zaghawa, the Midob (*i.e.* the inhabitants of Gebel Midob), the Berti (who call themselves Sigato), the Tungur, the Dagu, the Fur, and a number of smaller and even less-known groups, including the hereditary vocational group (caste), the Ḥadaḥid (ironworkers), "most of whom certainly originate from Wadai or west of it," and who are everywhere looked upon with such aversion and contempt that, though scattered about the country, they

have been welded into a single social group. All these peoples seem either to profess Islam or have at least been greatly influenced by it; on the other hand, the account of the author's experiences of actual religious observances of the Midob, the Dagu, and the Fur indicate that the working beliefs of these tribes are akin to those which the writer of this review has observed among the black hill peoples of southern Kordofan.

This concludes Part I.; in Part II. we are given a careful and scholarly account of the progress through Egypt in mediæval times of the ancestors of the more important Arab tribes now represented in the Sudan. In this section the author answers some of the questions implicitly if not explicitly posed in his earlier work, 'The Tribes of Northern and Central Kordofan.' No one could read that work without wondering how and with what following the ancestors of the various tribal groups reached the Sudan; here it is explained—to take, as an example, the Guhayna (and who in Kordofan, discussing their origin with Arabs, has not speedily come upon Abdulla el Guhani?)—that they were amongst the first of the Arabs to accept Islam, that they took part in the conquest of Egypt and the first Libyan expedition, and that in the ninth century they joined the Beni Raba in their invasion of the Beja country. By the fifteenth century, after much fighting with the Ḳuraïsh, they had become the most populous tribe in Upper Egypt, and had penetrated far into Nubia. "Then the tribes of the Guhayna Arabs spread over their country and settled in it and ruled it and filled it with rapine and disorder. At first the kings of the Nūba attempted to repulse them, but they failed: then they won them over by giving them their daughters in marriage. Thus was their kingdom disintegrated, and it passed to certain of the sons of Gahayna on account of their mothers [*sc.* being Nūba of the blood-royal], according to the custom of the infidels as to the succession of the sister or the sister's son. So their kingdom fell to pieces, and the A'rab of Guhayna took possession of it" It is not surprising to read that after this there was "no vestige of authority in their land, since the result of the commingling and blending that has taken place has merely been to exchange the old ways for the ways of the Bedouin Arab."

The remainder of the first volume, constituting Part III., is devoted to an account of those tribes in which the Arabic element preponderates, or at least warrants the popular conception of them as Arabs. It is one of the admirable essays based upon the information contained in the native manuscript translated in Part IV., to which reference has already been made, and it is mainly from these manuscripts—for the most part *nisba* "pedigrees" of the more important tribes or sometimes of individuals, but including certain more general historical treatises—that Mr. MacMichael has been able to draw cerain outstanding conclusions as to the population of the northern Sudan.

The first point of note is that all over the Sudan definite distinction is made between two great congeries of tribes claiming descent on the one hand from 'Abbas, the uncle of the Prophet, and on the other from the Guhayna. The former, the Ja'alin-Danagla group, includes many riverain tribes, as well as many of the sedentaries of Kordofan, the latter the Baggara and many camel-owning nomads. Secondly, the author considers that four great waves can be distinguished in the tide of immigration, namely (i.) that entering through Egypt as the result of the conquest of the country; (ii.) that across the Red Sea and through Abyssinia in the eighth century; (iii.) that in the thirteenth and fourteenth centuries resulting from the conquest of the Christian kingdom of Dongola; and (iv.) that following the conquest of Egypt by the Turks in the sixteenth century. All these invasions entered the country from north

or east, and there is little evidence of any considerable reflux into the Sudan from the Arab domains in north-west Africa. C. G. S.

AFRICA

A Comparative Study of the Bantu and Semi-Bantu Languages.— Sir Harry H. Johnston, G.C.M.G., K.C.B., Sc.D. (Camb.). Oxford University Press. Vol. 1., 1919; vol. 2, 1922. *Price 63s. net each volume.*

Was there one Bantu race or were there two, one in Africa and the other in Asia? as stated by Homer and Herodotus (Theal, 'Ethnography of South Africa,' p. 150). Sir Harry Johnston boldly claims his semi-Bantu as originating from the African Bantu; for, at the moment, ethnologists fight shy of recognizing any Bantu race indigenous to Asia. Such a view overlooks two facts. First, the approach to West Africa by land is through Lake Chad district, either from the north through Tibesti, or from the Nile through Kordofan and Darfur; neither of which districts is anywhere near a Bantu area. Secondly, as a glance at the "Comparison of Noun Roots" (vol. 2, pp. 240–294) will abundantly demonstrate, there is a most confounding diversity of forms.

Having made an independent analysis of some hundred or more root ideas and taken some account of grammatical forms, it is the reviewer's firm conviction that there were two Bantu stocks, one indigenous to Africa and the other brought in by traders from Arabia through Kordofan to Lake Chad and West Africa. Kikuyu and Cwana (Suto) may be taken as typical of the latter type, both of them having phonetic peculiarities quite distinct from the ordinary type of Bantu. Kikuyu also retains peculiar words in its vocabulary, as Sir Harry notes.

"Their language," he says, "shows marked signs of isolation and locally developed peculiarities. Nevertheless, it is thoroughly Bantu, and the loan words from Nilotic speech are very few." A closer analysis would have shown one or two stray words having affinity with Tubu, the language of Tibesti; notably *ngorŏ*, the heart, Tubu *awor*, instead of the almost universal Bantu moyo, mwoyo. There may even be some traces of early Semitic in peculiar words, as *thii*, to go; *hinya*, strength (Sud. Arab. *hen*); *-garagaria*, to roll.

Of the phonetic peculiarities in Kikuyu we must only note one. Sir Harry writes (vol. 2, p. 29 *inf.*), "*u* in the prefixes is often broadened into *ω*, and *i* into *e*." This is not quite correct. The vowels *i* and *u* in all unstressed elemental prefix (and infix) syllables, as well as in the root vowel of many words, have a very peculiar pronunciation, very lax or open, so that they sound nearly as short *e* and short *o*. Technically the sound, as observed in Cwana, is described as "intermediate in quality between cardinal *i* and cardinal *e*"; "intermediate between the cardinal vowels *o* and *u*" (Jones, 'Sechuana Reader,' pp. xxiii., xxv.). This is a normal feature of Kikuyu and very unique.

Kikuyu, in brief, has a type of its own, equally primitive, in our view, with "the hypothetical Nyanza mother tongue," as Sir Harry calls the group to which Ganda belongs, the most common type in Africa. "Not only is it the most princely type of Bantu language, but it contains the dialects of that remarkable Bantu aristocracy, typified by the Hima caste, the Bunyoro and Buganda dynasties." The characteristics of this type, as Sir Harry conceives it, will be found in vol. 1, pp. 18–21, together with a critique of Lepsius' summary. This common African Bantu type differs somewhat from Kikuyu in its phonetic scheme, and, in addition, Kikuyu has two or three distinctly peculiar grammatical features not found in Ganda or normal Bantu.

But is this type so pure as Sir Harry's words imply? He writes, "though

in their far-back Nigerian origin the Bantu and semi-Bantu speech families may have been formed or influenced by the impact of Mediterranean Man on the Sudanese and Forest Negroes, I do not think that the Nyanza group owes its origin in any way to the incoming Hima or Gala type of negroid into Eastern Equatorial Africa." Now Sir Harry is one of the foremost leaders in the theory that North Africa is strongly influenced by the Mediterranean type. We must, however, express some surprise that he should extend this to the Strand-lopers of far-away South Africa (vol. I, p. 23) and even link up these two extremes with the proto-Arab trader. It is not impossible that in North Africa the Hittite played a far more important part than has been suspected. There are several hitherto unnoticed features which point that way; and it is even possible that the legend of Kintu, so persistent in all the district north of the Victoria Lake, both Bantu and non-Bantu—viz. that Kintu is the ancestor of all these peoples—is really a Bantu presentation of Ḥit-ti, the Hittite.

It has sometimes been said that the Hyksos were related to the Hittites. As the Hyksos were expelled from Egypt about 1600 B.C. there is a possible date to be discussed. Moreover, when we begin to look into African philology there are several unexplored possibilities which suggest that 2000 B.C. may not be far wrong for the date of the earliest temple in the old South African goldfield.* The reviewer would therefore venture to suggest that the several times repeated expression "thousands of years ago" or its equivalent is hardly necessary. For all reasonable purposes our Bantu history might be dated from 3000 B.C. or thereabouts. We cannot get much behind that date.

When we come to examine the actual philological detail of this marvellous collection of words and the equally marvellous memory of the author who can tabulate and compare without any very apparent scientific scheme as an *aide de mémoire*, well, there is quite a small book that might be written. For one thing, Sir Harry follows the Indo-European method of relating words by their consonants. In Africa it is the vowels that play the more important part. "No pure Bantu language includes obscure vowel sounds" (vol. I, p. 18); and in our view, this purity of vowel sound is maintained by varying the consonant values at the expense of the vowel. Feeling of all kinds, including natural temperament and idiosyncrasy, expresses itself in the consonant, not in the vowel, as in Indo-European. In spoken speech there are, it is true, a mere handful of cases where it is permissible, for emphasis, to lengthen the vowel, or more correctly to sustain it on its proper pitch with its normal quality. That is all.

There are immense possibilities of usefulness before these two volumes; but if they are to be fully realized, two things are, we think, essential. First, the imperative need of proper indices if this really valuable book is to be of lasting use. If we have in any way misrepresented the author, we must apologize; for the difficulty of finding one's place in these volumes and verifying a reference is tremendous. The kind of thing required has been exemplified recently in Sir Wallis Budge's Egyptian Dictionary; and previously in Cust's 'Languages of Africa.' We would also suggest a division of the map into large-scale sections, showing clearly the immensely useful geographical material contained in the notes of vol. I. Those who go to Africa for the first time want to know what is the local dialect and what is the prevailing *lingua franca*; and

* The reviewer would accept the dates derived from a discussion of the temple orientations. There are however grave reasons for mistrusting this method.—ED. *G.J.*

there is every reason why this desire to study the native language should be encouraged at our Universities and Oriental School. The necessary material is there in the notes which form a leading feature of vol. I, and is very fully dealt with. But its acquisition without adequate map or index is, to say the least, laborious and unsatisfying.

Secondly, the time is fully ripe for a periodical in which African philology and its bearings on ethnology can be fully discussed. The difficulties are largely financial. The second volume of this Comparative Study has had to be printed by private subscription; and the author freely admits several important omissions. These should be printed. Again, new African versions of the Gospels reach the Bible Society on an average of one every two months, a great number being Bantu. Everywhere officials and missionaries are studying new dialects. Co-ordination is urgently needed, and could be given by systematic teaching. South Africa has set an example with its School for Bantu Studies and (it is to be hoped) the fairly regular appearance of a periodical. The home country has far greater opportunities to tackle the whole subject, with a consequent gain to our African possessions of incalculable value.

W. A. C.

An Elementary and Practical Grammar of the Galla or Oromo Language.— A. W. Hodson and **C. H. Walker.** London: S.P.C.K. 1922. *Price 12s. 6d. net.*

This work falls into four sections: phonetics (3 pages), grammar (104 pages) stories (15 pages), two vocabularies of verbs and an English-Galla vocabulary of other words (71 pages), and a key to the exercises.

The transcription is not always fully explained; what, for example, is the difference between *ch* and explosive *ch*? It seems probable that both this and the "explosive *t*" are cerebral sounds. As the Amharic alphabet is used in places and the student is urged to learn it, it is a little unkind not to give its equivalents in Roman characters. The work is intended to serve purely practical purposes; consequently it passes over without notice such interesting problems as the meaning of the identity of form in the feminine of the nominative and objective. There are however points, such as the place of the stress in verbs (p. 64–5), which might well have received more attention: all we are told is that the accent varies; no examples are given.

In a future edition the authors will do well to enlarge the index, for there is nothing more irritating than a search for information which may have been given in a footnote to a text. It would also be of great advantage if one or both the authors could take a brief course on phonetics when they are in England. Their transcription is so much better than usual that it would be a pity not to improve it to the utmost.

N. W. T.

AUSTRALASIA AND PACIFIC ISLANDS

The Hill Tribes of Fiji.— A. B. Brewster. London: Seeley, Service & Co., Ltd. 1922. Pp. 308. *Illustrations, Map, and Index. Price 21s. net.*

Although this very interesting book does not treat primarily of geographical matter, it contains enough information about a tract of country which is intimately known to only a handful of Europeans to enable the reader to gather a working acquaintance with its physical features and a knowledge of the relative situation of the natives' tribal lands which no map or handbook hitherto published can impart. The author, who has spent half a lifetime in Fiji, was for many years Resident Commissioner in the two highland provinces of the interior. He went to that appointment with an intimate understanding of

the natives' character, abilities, and limitations already acquired; and the present volume is one of many proofs that Mr. Brewster made excellent use of his opportunities.

The mentality of the Fijian, notably where the highland dwellers are concerned, is nothing if not quaint. But, as the author remarks (p. 201), "One learnt never to be puzzled by Fijian ideas and impressions"; and he quotes one of numerous instances of bizarre reasoning in which a woman who, having a serious and legally valid grievance against several of her tribe for which she desired to be avenged, cut off her little finger in order that the Commissioner should hear of it and deign to investigate the matter, though she might easily have laid an information against her persecutors in the ordinary way. To grasp the psychological processes by which the natives arrive at their concepts and govern their behaviour, a close familiarity with the intricacies of Fijian social, domestic, and communal life is indispensable, and can only be acquired by long residence in their midst, strengthened by a frank fellowship with the chiefs and a willing ear to lend to the people's grievances. One has only to appreciate these difficulties and to read Mr. Brewster's account of his stewardship to understand how exactly he fitted his duties as a Prefect over these primitive natives, and as a discreet and merciful administrator of the laws of the land.

History, anthropology, folk-lore, incident, and anecdote make up the bulk of the volume; but there is a refreshing spice of quiet humour running through its pages, and this, with the simple narrative tense which prevails, make the reading exceedingly pleasant and entertaining. Two somewhat occult subjects on which Mr. Brewster's observations are of especial value are the *Tuka* and *Luve ni wai*. These practices offer problems which have puzzled experts in Fijian folk-lore for many a year; and are much too intricate to profit by discussion in a mere review. Let the inquirer therefore turn to chapters xxii., xxiii., and xxiv. of the book. No other literature exists on these subjects outside of the late Governor Sir John Thurston's despatches. *Tuka* is a dangerous psycho-religious cult which has taken hold of the mountaineers of Naboubuco at various times and proves difficult to extinguish. *Luve ni wai* is a sort of saturnalia and feasting secretly organized now and again by past masters in the game and indulged in by the youths of the male sex. Both are subversive of public discipline and seriously interfere with communal obligations and the respect due to superiors and elders; but the *Tuka* affords a definite menace to Government control, and calls for firm measures of suppression.

Mr. Brewster's book is receiving unqualified praise from all the old Fijian officials and settlers now in England, and can be confidently commended to the notice of every class of reader. It is one of quite the best books on Fiji.

B. G. C.

GENERAL

Handbook of Commercial Geography.— **G. G. Chisholm.** 9th edit. London: Longmans, Green & Co. 1922. Pp. xvi., 824. *Price* 25*s. net.*

This new edition of Mr. Chisholm's standard work will be generally welcomed. The book is so well known that it is unnecessary to do more, in this brief notice, than mention some of the points in which this edition differs from its predecessors. The last edition appeared in 1911, and the preparation of this one has been delayed from 1914 to 1922 by the War; and since the economic life of the world shows no indication of any early recovery from the effects of that catastrophe, the only period to which it is possible to refer for the study of normal tendencies is pre-war. Hence the statistical tables end with the

figures for 1913; though in many cases post-war statistics are added to illustrate present conditions and some of the effects of the War. The present edition is one-eighth longer than the last one. It has also been completely recast, and the material formerly included in the prefaces to the 4th and 8th editions is now incorporated in the body of the work. Nearly three-fourths of the added space is given to the general section, which now forms a very comprehensive account of the chief commodities which enter into trade, and of the conditions affecting the routes and centres of commerce. The sections dealing with the new states of Europe give a concise summary of their natural resources which will be found useful: more is hardly possible at present. The book remains indispensable to the geographer, and the immense labour and balanced judgment which have gone to produce it increase the debt of gratitude which all students of the subject owe to its author. C. B. F.

THE MONTHLY RECORD

EUROPE

The New Port of Venice.

A TIMELY account of the imposing project now in course of execution for the extension of the port of Venice appears in the new journal inaugurated by the Italian Geographical Society for the popularization of geography under the title *La Terra e la Vita* (Anno 1, Fasc. 5). The writer, Sig. Adriano Michieli, begins by sketching briefly the gradual development of Venice as a port from the twelfth century onwards down to the completion of the "Marittima" in 1880, from which the modern history of the port may be considered to date. Even this was far from affording sufficient wharfage for the rapidly growing commerce, the tonnage of goods entered increasing from about 680,000 in 1881 to a million in 1891, and 3 million in 1912. Projects for further development began to be studied in 1901, and in 1909 the preliminary works for the creation of an entirely new, subsidiary, port at Marghera on the inner margin of the lagoon were started. This new port (to be reached by a deep-water canal leading west out of the Giudecca canal to the south of the old city) was designed to accommodate all the movement of goods in transit to or from other parts of Italy, while the Marittima was to be reserved for local needs. The European war seemed likely to delay the scheme indefinitely, but a far-sighted policy prevailed, and already in 1917 the needed powers for proceeding with the scheme were obtained. Sig. Michieli describes the various component parts of the whole project, and illustrates the details of the new port and its connection with the old city by a map. The site lies immediately to the south of the Mestre–Venice railway, hitherto occupied by the Bottenighi shallows, where in addition to the canals, docks, and wharves a large extent of new ground will be built up for industrial purposes from the material excavated for the canals. An entirely new urban zone will also be created, to the west of the Mestre–Padua main road. The industrial zone will lie in two portions to the north and west of the port, and will be served by two deep-water canals branching out of the main canal of access. Its total area will be 8 sq. kms., and the canals serving it will have a total length of 7½ kms., whilst provision is made for the erection of a big railway station adjoining the docks. Already the main canal has been dug to a depth of 9 metres, as well as its prolongation to the northern industrial area, the development of which is well advanced. The work is a vast one, employing all the resources of modern engineering,

and the cost will naturally be enormous, but is held to be justified by the growing needs of the city. By the choice of an entirely new site for the new port it will be possible to meet the requirements of modern progress without destroying any of the typical characters of Old Venice.

ASIA

Brig.-General George Pereira's Journey across Tibet.

Brig.-Gen. Pereira is to be warmly congratulated on the successful completion of his remarkable journey from China across Tibet to India, his plans for which were referred to in the *Journal* for August 1922 (p. 155). The traveller reached Calcutta at the beginning of December, having made the journey from Tangar near Sining (from which place he had written to us on the eve of starting) by way of Lhasa, Gyantse, and Darjeeling. He has thus gained the distinction of being the only living European who has crossed the whole breadth of Tibet from north to south by way of Lhasa. We have received extensive notes on the journey through his brother, Major-Gen. Sir Cecil Pereira, and we hope to publish them in the next number of the *Journal*, illustrated by a sketch-map.

AFRICA

The Projected Trans-Saharan Motor Journey.

Reference was made in the *Geographical Journal* a year ago (59, 1, p. 72) to a proposed attempt to cross the Sahara from Algeria to the Niger by motor-car. The scheme has taken a long time to mature, but it is now announced that the party is to consist of M. George Haardt with three French military officers, and will have an official character. Southward from Insalah the route will traverse arid and difficult plains of sand varied by rocky patches for about 500 miles, after which the main crux of the venture must be encountered in the shape of an absolutely trackless and waterless desert, extending to the confines of the Niger basin where more luxuriant vegetation may again be looked for. After reaching that declivity a journey of 150 miles in proximity to the river-bank should bring the party to Timbuktu. It is intended to travel in four motor-cars, each fitted with a caterpillar attachment and carrying a pair of ten-gallon tanks to contain the water supply. The equipment is to be very complete, and relays of motor spirit are to be conveyed to the northern and southern margins of the desert proper by motor tenders. The expedition started finally from Tugurt on December 17.

Progress in Rhodesia.

A recent report on the Beira and Mashonaland railways, extracts from which have been supplied to us by the Department of Overseas Trade, includes some points of general interest in connection with the development of Rhodesia. The number of passengers entering and leaving the port of Beira in the year ended 30 September 1921 were 4192 and 3687 respectively, an increase over the previous year of several hundreds in each case. The census of Rhodesia taken in May 1921 showed a total of 33,621 Europeans in Southern and of 3634 in Northern Rhodesia, the percentages of increase since 1911 being 42·43 and 58·8 respectively. The citrus fruit industry continues to receive much attention, though somewhat hampered by inadequate cold storage on steamers from South Africa. The number of cattle moved by rail showed a great drop during the year, and as the Union (hitherto the chief outlet for Rhodesian and Bechuanaland cattle) can absorb but a limited proportion of the supply available, the opening of new markets is greatly needed. The present total stock is reckoned at 1,500,000 head. The general result of much discussion is to show

that Rhodesia must before long, if she is to meet the severe competition of older rivals, establish her own killing and freezing works and export her surplus cattle in the form of frozen carcases. It is thought that Beira will prove to be the best port of export for such surplus meat. A great impetus has lately been given to the production of cream and butter, poultry and eggs, some of which are already exported to a certain extent, both to Europe and the Congo, but the need of further organization of export facilities is now being felt.

AMERICA

The Mineral Resources of Canada.

Under the title 'Minerals and Mining Industries on the Canadian National Railways,' we have a pamphlet of sixty-three pages by C. Price-Green (Toronto: Issued by the Industrial and Resources Department of the Canadian National Railways, 1922), dealing in a non-technical manner with the mineral deposits on or near the Canadian National Railways. The minerals are arranged in alphabetical order, and under each a few notes are given descriptive of the mining industry. The attention of prospectors and others is particularly directed to the undeveloped areas in the territory served by the railways in northern Quebec, northern and western Ontario, northern and south-eastern Manitoba, and British Columbia, as amongst the best fields for investigation.

A New Map of the Basin of the Amazon.

For some years past the Rev. O. R. Walkey, whose missionary expeditions in the interior of South America are well known, has been engaged upon the compilation of a large map of the Amazon River and its tributaries, and before his departure for South Africa in 1922 he brought this work to completion. The map, which according to the title is of the 'Amazon River Plain,' is important, and includes the whole basin of the river with the exception of the upper courses of its southern tributaries. Much of this region is still unexplored, and such mapping as has been done is, in many parts, of the roughest; but Mr. Walkey has spared no pains to make the best use of the material that exists, and his compilation has been most carefully carried out. He is especially qualified to undertake a work of this kind from his personal knowledge of the country and of survey methods and astronomical observations, which enabled him to judge of the relative merits of the large number of maps and documents he had to deal with as the work progressed.

The principal object in view in the preparation of the map was to assist future missionaries and other travellers in their river boat voyages, and for ease and facility of setting off bearings Mercator's projection was selected; but as the latitudes included extend only a very few degrees on either side of the equator, several other projections would have served equally well for all practical purposes. The equatorial scale is 1 : 1,460,000 or 1 inch to 20 nautical miles (= 23 statute miles), and this again was doubtless selected with a view to simplifying the measurement of distance by the navigator; but after all there is little to be said in favour of the selection of an odd scale of this sort, and it would have been more generally useful to have drawn the map on the scale of 1 : 1,500,000.

So far only photographic reproductions of the author's original drawings are available, for which reason the map is somewhat rough in appearance and style of execution, although fairly legible. There are altogether 10 sheets, each measuring $26 \times 19\frac{1}{2}$ inches. In addition to the general map there are several insets, vertical sections, diagrams showing the depths of water in the rivers at different periods, and tables of distances, all of which are useful. There are

also many notes; and altogether the map is the most detailed and complete up to the present time, and will certainly be of considerable value to all who are interested in this part of South America.

Copies can be obtained from Messrs. W. F. Stanley & Co. (13, Railway Approach, London Bridge, S.E.) for £2 the set uncoloured. Arrangements have been made for the hand colouring of water and boundaries, which adds much to the clearness, and these coloured copies can be purchased for £3 5*s*.

E. A. R.

Chilean Earthquake of 11 November 1922.

Early on November 11, or shortly before midnight on November 10 (local time), one of the greatest of Chilean earthquakes occurred. The accounts which, up to the time of writing, have reached this country seem to indicate that the shock was at no place of excessive strength. There was, it appears, none of that widespread desolation that is so often wrought by violent earthquakes of shallow origin. Much of the damage, indeed, was caused by the sea-waves which, as is so often the case in Chile and Peru, swept in shortly after the earthquake. The most remarkable feature of the shock was the vast extent of country over which it was felt. Along the coast it was readily sensible from Antofagasta on the north to Valdivia on the south, places that are separated by a distance of 1100 miles. Most of the accounts so far received come from the narrow belt of country between the sea-coast and the Andes. Towards the east, however, the shock was felt at Buenos Aires, about 900 miles from Coquimbo. Towards the west, it is said not to have been felt at Crusoe Island, less than 400 miles from the mainland. The shock was most strongly felt from Coquimbo to Copiapo, the relatively greatest destruction being at Vallenar, about midway between these towns. The sea-waves swept over the coast from Antofagasta to near Concepcion, a distance of about 1000 miles, and were large enough at Hilo in Hawaii to drive boats from their moorings, and even to cause damage at that port. The occurrence of these waves shows that the origin was submarine, and that the earthquake was accompanied by a deformation of the ocean-bed. The epicentre was probably some distance from the coast in the latitude of Vallenar, and may have been near the southern end of the Richards deep, a narrow trough which attains a depth of 4100 fathoms. The earthquake was followed by many after-shocks, one at least of which was succeeded by sea-waves and was strong enough to be recorded by seismographs in this country. One of the latest accounts reports the disappearance of Easter Island, but the rumour is probably without foundation, though damage may have been caused by the sea-waves. In any case, the island, which is more than 2000 miles from the coast, must lie far outside the disturbed area of the earthquake.

AUSTRALASIA

Modification of Drought by Human Agency in Australia.

Mr. E. T. Quayle, whose demonstration of the improvement of rainfall in Victoria and New South Wales in the vicinity of grasslands and growing crops where before was drought-resisting scrub and forest, and of inland sheets of water and irrigated surfaces, was recently noticed in this *Journal* (vol. 59, p. 474), has followed up this line of investigation into South Australia (*Proc. Roy. Soc. Victoria*, vol. 34 (N.S.), pt. ii., 1922). He finds that following upon settlement there has been an undoubted change for the better in the hydrographic region of the country around lakes Torrens and Frome, such that these lakes are impounding more water than formerly, with a demonstrable increase in the rainfall.

It is maintained that pastoral occupation is steadily reversing the natural process of desiccation due to the drought-resisting Australian vegetation, and that the clearance of forest areas has been followed by types with freer transpiration, as well as by the liberation into the drainage channels of much water which was formerly held up. Mr. Quayle advocates a national policy for enhancing to the utmost the improved tendencies on lines already indicated in his previous paper. His conclusions are, perhaps, hardly likely to be generally accepted without question, as they seem to directly contradict the common belief in the value of forest as a means of conserving moisture that would otherwise run to waste. The special nature of the Australian bush may however produce abnormal conditions.

POLAR REGIONS

Davis Straits in 1922.

Captain H. T. Munn, whose observations during many voyages to the region of Davis Strait and Hudson Bay have from time to time been recorded in the *Journal*, sends us some notes on his experiences in Davis Straits during the past summer. The ice conditions were again unusual. Early in August ice was close in to the land from Cape Mercy in 65° 5′ N. to Coutts Inlet in 71° 58′ N. This was all Baffin Land coast ice, and it extended east, under the influence of light westerly winds and calms, about 134 miles east of Cape Kater, or more than halfway across the Straits. The Baffin Land coast was inaccessible as far north as Coutts Inlet on August 26. No "Middle Ice" was seen, and it was evidently small and well to the eastward, clear water being found running up into the "North Water." When returning south, attempts were made to get to land at Scott Inlet, Clyde River, Cape Kater, Cape Broughton, and Cape Dier, but close ice was met in every case, generally from 15 to 30 miles off the land. The weather to the middle of September was exceptionally fine.

In 1921 the Middle Ice was also unusually small, and in August there was a wide strip of water on the west side of the Straits, with about 20 miles of ice along the Baffin Land coast. In 1920 the same general conditions obtained, but there was practically no ice along the coast in mid-August. It is probable that a jam of ice has occurred at the west end of Jones Sound, and also in Wellington and Byam Martin channels north of Barrow Strait, and possibly in McClure Strait and Kennedy Channel. When these jams come away a very extensive and heavy Middle Ice may be expected. Early in September there was much ice in Cumberland Gulf, and the station towards the head of the gulf could be reached with difficulty. Shore ice stretched across the gulf on September 20 from Cape Mercy to Cape Murchison, and only the action of a north-westerly gale permitted the ship to work through it. Captain Munn's vessel brought home from the gulf the master and crew of the *Easonian* of Dundee, which had been burnt to the water's edge on September 10.

Captain Munn mentions that one of his Eskimo hunters shot and killed this spring, with a ·303 Service rifle, a full-grown "right" whale (*Balæna mysticetus*) with over 11 feet of bone. Although about thirty shots in all were fired, the natives believed that the first shot (through the heart) would have "stopped" it. The whale had been driven by "killer" whales (*Orcus gladiator*) into a crack in the ice where the water was probably too shallow for it to sound. This is probably the first time that this huge whale has been killed with so small a weapon, though during the war a hydroplane pilot killed a large "finner" whale with a quickfirer, thinking it to be a submarine.

During the past summer the Canadian Government S.S. *Arctic* left an officer and men of the Mounted Police on Ellesmere Island at the entrance to Jones Sound to effect a formal occupation of this and adjacent islands, always claimed as Canadian territory. Police posts have also been established on Eclipse Sound and Bylot Island, and next year other posts will be established in Cumberland Gulf and southern Baffin Land.

GENERAL

A Remarkable Atmospheric Phenomenon observed at Sea.

A correspondent, Dr. A. Birnham-Smith, sends us a short description of a remarkable optical phenomenon observed by him on 22 March 1908 on board the S.S. *Eden Hall* in the Persian Gulf, to which it seems desirable to call attention by reason of its unusual and puzzling character, in spite of the time which has elapsed since the date of the occurrence. Shortly after passing Ormuz the writer, together with his wife and sister, saw the ocean entirely lit up by luminous rays, and on calling the attention of the master of the vessel, Captain Petersen (described as a phlegmatic Norwegian little likely to be carried away by the imagination), and others to the sight, was assured that nothing like it had ever been observed before. Further details are given in a private letter written at the time and kindly sent for our inspection. It was dark at the time, with a very glassy sea, when it suddenly appeared as if some one was turning flashlights on the ship (which was not provided with electric light). It turned out to be waves of light wheeling round the ship in the air just over the sea, and not actually on the surface. The phenomenon was observed for twenty minutes by all on board. Although, as we have said, the appearance seems to be an unusual one, a very similar phenomenon was reported in 1909 by the master of the Danish East Asiatic Company's steamer *Bintang*, Captain Gabe, as seen in June of that year during the passage through Malacca Strait, and a printed description was afterwards issued by the Danish Meteorological Institute, with an illustration. In this case the phenomenon is said to have resembled a revolving light, with a pretty fast rotation, the light-waves taking the form of long arms issuing from a centre which seemed to lie on the horizon. Inquiries instituted with a view to learning whether other observations of such a phenomenon existed at first met with negative replies, but eventually the report of a similar experience was obtained through the Dutch Meteorological Institute from Captain Breyer of the Dutch steamer *Valentijn*, who in 1910 observed the phenomenon near the Natuna Islands in the South China sea.

Cattle-rearing Regions of the Southern Hemisphere.

Dr. Leo Waibel of Berlin has contributed to the *Geographische Zeitschrift* (1922, Heft 3–4) a study of the conditions which have determined the enormous development of live-stock farming over such wide areas in the southern hemisphere. Owing to their remoteness from the northern centres of civilization, these southern regions had to wait for their development until steam-ship navigation made communication rapid and easy, while at the same time the farm products of the north became insufficient for the needs of the inhabitants; and when such development began, it was fostered almost solely by cattle and sheep rearing. In position and natural conditions Australia, southern South America, and South Africa present close analogies, but at the same time some differences, especially as regards climate, for while Australia and South Africa lie within the sub-tropical area of high pressure and are markedly dry, Argentina and New Zealand are far better off as regards rainfall, even though this is

somewhat uncertain in the first-named. Temperature is comparatively high everywhere, and snow rarely occurs because the winters in Australia and South Africa are too dry, in Argentina too warm. These climatic conditions make all three pre-eminently grasslands, and thus marked out for stock-raising, the possibility of keeping the animals in the open throughout the year being an added advantage. The value of the pastures differs greatly, however, so that the capacity of the farms for stock differs enormously in different areas, the number of head of sheep per square kilometre varying from 1500 to 2000 in parts of New Zealand to 40–50 in Patagonia. The writer describes briefly the course of development of the industry in the several regions, and the special conditions which have caused differences between them, *e.g.* the predominance of sheep in Australia and of cattle in Argentina. Argentina outdistanced the others partly through having the start through its earlier settlement. If we regard one head of cattle as equivalent to five of sheep it shows a total of 330 million head as compared with 200 million for Australia and New Zealand together and 75 million for South Africa. In Australia the extent of unproductive country keeps low the figure per unit of area, but even when this is eliminated the La Plata lands show 110 head per square kilometre against 25 in Australia and 6 in South Africa. Although in the last-named the danger from wild animals is the greatest, this is a totally insufficient reason for its relatively backward position, which must be ascribed rather to historical and social conditions, such as the frequent wars. It is the sparsity of population and the resulting small local requirements which give cattle-rearing its importance in all three regions as a source of export trade. But there are considerable differences in this respect, as is shown by dividing the figure for stock-density by that for population-density. Whilst the quotient for La Plata is 33 and for Australia and New Zealand the little-inferior figure of 31, for South Africa it works out as 1·2 only. The relative importance of the different products of the industry (wool, meat, etc.) at different periods and in the different areas is also discussed, and the total value of the export of such products is given. Whereas before the war Australia held the lead, it had fallen distinctly behind Argentina by 1917. The war has given a great impetus to the industry in Brazil.

Geography in Europe.

A good deal of attention has lately been given in the United States to the present position of geography both in this country and in other countries of Europe. The ' Position of Geography in British Universities ' was the subject of one of the earlier issues of the Research Series inaugurated a year or two ago by the American Geographical Society, which entrusted the writing of it to Sir J. Scott Keltie. This has been followed by a survey of " Recent Geographical Work in Europe," in the *Geographical Review*, published by the same Society, for July 1922.

These two documents may well be regarded as the completion of the long series of articles in the *Geographical Journal* and elsewhere which have set forth the merits of geography and pleaded for its inclusion in both school and University education. The report by Sir John Scott Keltie breathes the spirit of progress in the British Universities. " We are justified in congratulating ourselves that after thirty-five years' hard work amid much discouragement geography in Britain, as a field of research and education, has attained a standard not far short of that which has existed in Germany for double that period, and has been recognized in most of our universities as a permanent and welcome addition to their programmes."

Mr. Joerg reviews the wider field of Europe, and his survey is valuable not only because it brings into a comprehensive view the present position of geography on the Continent, but because it gives an excellent *résumé* of the recent research work by various prominent geographers. France, Germany, and Italy, where geography was early recognized, still lead the way and undoubtedly are helping towards a solution of the problem raised by Sir John Scott Keltie, namely, the determination of the limits of the field to be covered in geographical investigations.

The evidence of Mr. Joerg shows that the work on the Continent is following two main lines. In one case, men with a definitely geographical outlook are investigating special problems of a political, social, ethnographical, or geological character; in the other a serious attempt is being made to investigate all the phenomena of a region, not as isolations but as component forces in a state of equilibrium. Both lines of investigation are requisite to geographical research, though it is possible that the regional basis will finally come to be regarded as fundamental in an advanced study of geography. W. H. B.

Geographical Lectures at the London School of Economics.

We understand that a course of eight lectures on "Changing Geographical Conditions" will be given by Sir Halford Mackinder early next year at the London School of Economics, Houghton Street, W.C.2. They will be on Wednesday at 5 p.m., beginning on January 24, and will deal with the great World-problems as affected by the changing relations of Man to his physical environment. These lectures should appeal to all students of political and economic geography. The fee for the course is 12*s*.

The Oxford Spitsbergen Expedition: Erratum.

We find that by an unfortunate accident one of the pictures illustrating Mr. Frazer's paper in the November *Journal* on the work of the above expedition ("Looking north from Camp IV.," facing p. 332) was inserted upside-down. The similarity of tone between the sky and the snow-covered foreground renders the mistake far from obvious without close inspection.

Fifth International Congress of Historical Studies.

This Congress is to be held in Brussels from April 8 to 15 of this year, under the patronage of the King of the Belgians. Its organization will be generally the same as that of the four preceding Congresses, held successively in Paris, Rome, Berlin, and London between 1900 and 1913, but its scope will be somewhat enlarged, and in all 13 sections will be constituted. The executive committee is at work under the Presidency of Prof. M. H. Pirenne, of the University of Ghent, and the secretary is Dr. M. L. F. Ganshof (12, Rue Jacques Jordaens, Brussels), who will receive applications for membership (subscription 50 Belgian francs) and give any information desired.

OBITUARY

Captain James Edgar Ballantine.

We regret to record the death, on 24 September last, of Captain J. E. Ballantine, known for some years to almost every visitor to Burma as Commodore of the Irrawaddy Flotilla Company's fleet. He had been a Fellow of this Society since 1900. Born at Norton near Stockton-on-Tees on 23 November 1856, he went

to sea at an early age, joining the *Helen Denny*, of the Patrick Henderson Line, as an apprentice, and seeing a good deal of the world in his various voyages. He entered the service of the Irrawaddy Flotilla Company as junior officer in 1876, and gradually worked his way to the top. Many of his passengers remember his burly figure, his courtesy and kindness, and the fund of information and good stories he had at his command. During the 'seventies, under the native *régime*, Upper Burma was of course comparatively little visited by Englishmen, but Captain Ballantine secured the friendship and esteem of King Mindon Min, to whom he paid frequent visits at Mandalay. He was in the capital at the time of the massacre of the royal princes by the bloodthirsty Thebaw, on his succession to the throne, and he played a small but useful part during the British occupation, receiving the thanks of Government for his services in relieving a village threatened by Thebaw's troops. After his retirement in 1908, he lived at Chiswick, and afterwards at Brighton, where he made many friends. His widow survives him. T. A. B.

Rev. H. S. Cronin.

The Rev. Harry Stovell Cronin, B.D., whose death at Cambridge on 26 October last we record with much regret, had been a Fellow of the Society since 1903. Although his career was not actively concerned with geography (he had been Dean of his College—Trinity Hall—for a number of years) he was in full sympathy with the subject, particularly in its historical aspects. His interest in these had been aroused when travelling in Asia Minor, not long after taking his degree, in the company of the distinguished archæologist Sir W. M. Ramsay.

After his return to Cambridge he continued to devote some attention to that part of the world, undertaking a study of Ptolemy's map of Asia Minor, and the method of its construction, on which subject he read a paper before the British Association at the Cambridge meeting in 1904 (see *Journal*, vol. **25**, pp. 429 *et seq.*). He was a man of wide interests and of a most kindly nature, and his loss will be severely felt by his friends. The end came suddenly, though he had been ill for some time. His father, Mr. W. D. Cronin of Hampstead, who survives him, has been a Fellow of the Society since 1895.

Lewis H. Ransome.

Mr. Lewis H. Ransome, whose death occurred at Newark in May of last year, had been a Fellow of the Society for over thirty years, having joined in 1890. Born in London in 1862, he was educated at Rugby, and on leaving school entered the well-known firm of A. Ransome & Co., of London and Newark, which had been founded by his father, Mr. Allen Ransome, for the making of wood-working machinery. His whole business life was devoted to the interests of the firm, of which he eventually became chairman; but he was known in wider circles as an authority on timbers. Whilst quite a young man he was associated with his father in the testing of samples from the colonies exhibited at the Colonial Exhibition of 1886, and it was for the study of the timber resources of north-east Madagascar that he paid a visit to that island in 1888. During this journey he made a map of the Antanambalana river, which enters the head of Antongil bay, and on his return he gave an interesting account of the country visited in the *Proceedings* of this Society, with map (N.S., vol. **11**, 1889, pp. 295 *et seq.*).

CORRESPONDENCE

Dr. Klute's Map of Kilimanjaro.

SINCE reviewing Dr. Klute's Kilimanjaro book (*Geo. Journ.*, vol. 60, No. 4, p. 300) I have seen Oehler's account of the mountaineering exploits of the 1912 expedition (*Zeitschrift des Deutschen u. Oester. Alpenvereins*, vol. 46, 1915, pp. 124–156) as well as Dr. Klute's description of the topographical work "Die stereophotogrammetrischen Aufnahmen der Hochregionen des Kilimanjaro," *Zeitschrift der Gesellschaft für Erdkunde*," 1921, pp. 144–151), two papers which contain the necessary data to form an opinion on the accuracy of Klute's Map of Upper Kilimanjaro.

With regard to geographical position, the new map has been tied in with the Anglo-German Boundary Commission's triangulation, and though a proper detailed triangulation of the sixty-three photogrammetric stations was not attempted, the methods employed in the field, as well as the mode of reconciliation adopted, appear, by various checks, to guarantee all that can be desired within the limits of accuracy given by the scale of the map.

With regard to contouring one would have expected—and liked—the altitudes of the photogrammetric stations to have been determined trigonometrically, and it is, therefore, a great disappointment to find that these altitudes are, once more, only the results of barometric measurement. The establishment of a barograph and thermograph at base stations at 2730 and 4130 metres respectively, the frequent checking of the aneroids by boiling-point determinations, the undoubtedly great care with which the actual observations have been made, and the up-to-date methods of computation, are all factors making for as high a standard as possible. But the serious drawbacks inherent in the aneroid, especially when used at great altitudes, and the complications with regard to temperature corrections on the slopes of a mountain where next to nothing is known about the laws of decreasing temperature, are, in my opinion, bound to reduce the absolute value of the altitudes shown on the map, however well the stereophotogrammetric contours of a limited area may express relative altitudes.

A further disappointment is the figure given for the actual summit of Kibo (5930 metres). It now appears, a fact which could not be gathered from Klute's book, that the explorers never reached the highest point, but, after a most gallant attempt over the western glaciers, had to return from the crater through the great gap in its western rim. The adopted figure is merely an estimate, based on the altitude of point 5910 on the western crater rim, which itself was only determined by aneroid (Klute, *l.c.*, p. 148).

So far, therefore, my own boiling-point determination at Johannes Notch (5880 metres) on 19 October 1921 still appears to be the only direct observation on the crater rim which is free from the drawbacks of the aneroid, and it is very much to be regretted that a comparison with Klute's results is rendered very problematical by the fact that the eastern crater rim is certainly the weakest part of his map, a scrutiny of which shows that the contours of that area are derived from two stations merely (Nos. 14 and 55), 7 and 5 kilometres distant respectively.

C. GILLMAN.

10 November 1922.

Mountain Names in Hunza.

I was naturally extremely interested in General Cockerill's paper on "Byways in Hunza and Nagar," which appeared in the *Geographical Journal* for August 1922. There are one or two remarks I should like to make.

Regarding the high peak Malungi Dias, 25,668 feet, the name Dumāta was given us at the Hunza capital. I do not think the name given to us has any significance for the peak itself, but refers to the whole massif between the Malungutti glacier and the Hunza gorge. General Cockerill's name, Malungi Dias, was, I believe, given him in the Shingshal gorge, and must refer to the highest peak itself, for it is the only peak visible from there.

On p. 107 General Cockerill observes that the range, which is crossed by the Kilik, Mintaka, and Khunjerab passes, is called the Sarikol range on the 1 inch to 4 mile map of Hunza, published in 1915. This is a mistake on the map, and the name should be deleted. The Sarikol district is on the Pamirs, and I cannot imagine how the name ever found its way to the watershed on the southern border. As General Cockerill knows, these ranges have no local name. After our work in those parts in 1913, I suggested that as the range on which the Irshad pass lies was part of the northern branch of the Hindu Kush, this range extended along the watershed between the Ab-i-Wakhan and Chaprusan to Tong-i-tuk h.s. (19,135 feet); then to peak 21,019 feet, east of the Hunza valley. The Gulquaja and Kilik branches of the Hunza river have cut back into the range and thrown the watershed north of the old alignment, capturing more than one Pamir glacier. The question of the geographical name to be applied to this range is being referred to the Surveyor-General for consideration and decision; and he wishes me to thank General Cockerill for having pointed out the error in the map.

The exploration and survey of the Ghujerab, Khunjerab, Shingshal, and Batura have not been lost sight of, and it is hoped that one of the officers stationed at Gilgit will come forward with proposals shortly and apply for one of our Indian surveyors to accompany him. General Cockerill's work was extraordinarily accurate considering the difficulties of the ground and the lack of triangulated points; but more points are available now and much remains to be done.

KENNETH MASON.

Dehra Dun, 2 November 1922.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1922–1923

Second Evening Meeting, 27 November 1922.—The President in the Chair.

ELECTIONS.—Lieut. Arthur Cyril Allen, R.N.; Herman Andreae; Lieut.-Colonel Stanley Barry; Captain Hubert Beaumont; Edwin John Beer, F.G.S.; Charles Dalrymple Belgrave; Dr. Mark Benson; Frederick George Binney; Miss Elizabeth Thurston-Bowring; James John Breeze, B.A.; Major Rupert Brett, D.S.O.; Evelyn Ronald Brodrick Graham; James Richard Holcombe Cruikshank, B.A.; Miss Constance Marion Chalk; W. Tees Curran; Edward Hilton Eyre Cutbill; George Gordon Dennis; Alfred Ehrenreich, PH.D.; Ernest Arthur Emery, B.A.; Mrs. Enid Gordon Gallien; Lady Hambro; Right Hon. Lord Gainford of Headlam; Henry Hoare; Alexander Gordon Ingram;

Edward Owen Jones; Hyde H. A. Kennard; Harold Lowther; Sir James Kenneth Douglas Mackenzie, Bart.; Eric Leslie Mellersh, M.A.; Miss Elsie G. Milner; Thomas John Morgan; W. F. Morris, B.A.; Herman Norden; Miss Dorothy Gwendoline Parsons; Herbert James Payne; Reginald Walter Perry, B.A.; Leslie T. Pollard; Mrs. Mary Pickering; Miss Edith Prankerd; Morris J. Raphael, D.SC.; Edward Everett Reid; Miss Gertrude Saville, LL.A.; Lieut.-Colonel James Edward Hill Sawyer, M.A., M.R.C.P., R.A.M.C.; B. E. Sharwood Smith; Murray Thorold Smith; Walter John Souch; Lionel Sproule; Dr. George Stewart (Jnr.); Mrs. H. Stobart; Lieut.-Colonel F. B. G. Tottie, J.P.; Henry R. Wagner; Captain George Hubert Wilkins, M.C.; Aubyn Harold Raymond Wilson.

PAPER: An Ascent of Kilimanjaro. C. Gillman.

Third Evening Meeting, 11 December 1922.—The President in the Chair.

ELECTIONS.—Robert Aitken; Prof. Arthur Andrews; Basil Woodgate Lechmere Ballard, B.A.; Miss Phyllis Wray-Bliss; Leslie Brettle, B.A. (OXON.); Albert Edward Church; Miss M. Emily Cooke; Victor Brabazon Cox; Thomas Morris Davies; Miss Eva Mary Godman; Dr. Thomas Greenwood; Rev. Owen Lechmere Hamer; Henry George Alan Harding; Mrs. Mabel Heathcote; Charles William Hobley; Mrs. Emily Godwin Fry Lockyer; James Joseph Nolan; Alexander Parvis; Captain Herbert E. Pease, D.S.O.; Miss Berly T. de Pledge; Edward Richardson; Mrs. Rush; T. R. Spiller, M.A.; Mrs. Edith Leonora Starr; Lieut.-Colonel Edward L. Strutt, C.B.E., D.S.O.; Harold Beken Thomas; Miss Violet Helen Truman; George Albert Tue, M.A.; William Rupert Alfred Weatherhead; Captain Henry Case Wilcox; Dr. Albert Wilmore.

PAPER: The Alps of Chinese Tibet and their Geographical Relationships. Prof. J. W. Gregory.

First Afternoon Meeting, 20 November 1922.—The President in the Chair.

PAPER: The Equipment for High Climbing. Capt. G. I. Finch.

Second Afternoon Meeting, 18 December 1922.—The President in the Chair.

PAPER: The Scheme for the proposed determination of Primary Longitudes by International Co-operation. Colonel Sir Gerard Lenox-Conyngham.